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February 15, 1989

Energy Research Abstracts

Abstracts 4080-5730

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UNITED STATES DEPARTMENT OF ENERGY

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ENERGY RESEARCH ABSTRACTS

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The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases, plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

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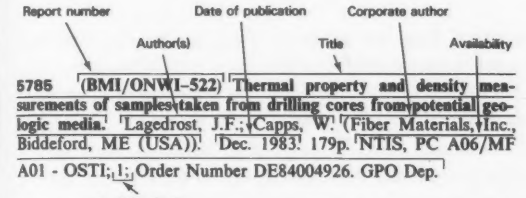
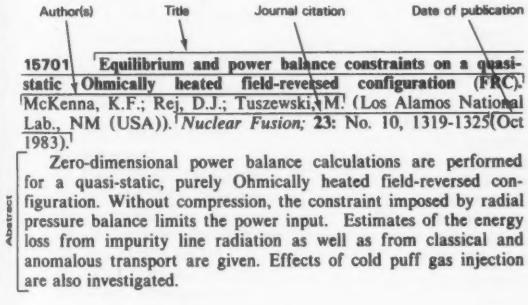
The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01 - OSTI; I; Order Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS Order Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

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DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order number–report number correlation is included for convenience.

BMI/ONWI-522	9:5785	NTIS, PC A09/MF A01. OSTI Order Number DE84004926, Distribution Category MN-70

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

4080 **(DOE/PETC/QTR—88/1) [Pittsburgh Energy Technology Center] quarterly technical progress report for the period ending December 31, 1987.** (USDOE Pittsburgh Energy Technology Center, PA). Jul 1988. 160p. NTIS, PC A08/MF A01; 1; GPO Dep. Order Number DE88015351/JAW.

The Pittsburgh Energy Technology Center (PETC) concluded Clean Coal Technology negotiations with: Coal Tech Corp., Babcock and Wilcox, and Energy and Environmental Resources, Inc. (EER). The $800,000 Coal Tech project will demonstrate that an external wall-mounted, 30 MMBtu/hr, advanced-cyclone-action coal combustor can be successfully retrofitted onto a 23 MMBtu/hr industrial boiler designed for oil firing with a minimum reduction in Btu output. The Coal Tech cyclone burner was successfully operated for more than 50 hours. Progress to date in demonstrating the use of the cyclone combustor technology with dry pulverized coal at an industrial scale has been very good. Babcock and Wilcox' $19.4 million two-part project to develop retrofit acid rain precursor technologies began construction activities. Much of the apparatus necessary for demonstration of the Coolside and Limb processes was installed. The potential of gas reburning and sorbent injection technologies applied in tandem to enhance the use of coals will be investigated by EER. Also, agreement was reached with Ohio-Ontario Clean Fuels, Inc., of Warren, Ohio, and negotiations are proceeding with TRW Energy Products Group of El Segundo, California. Ohio-Ontario Clean Fuels will construct a prototype commercial plant that will coprocess coal and residual petroleum to produce clean liquid fuels. TRW has proposed to demonstrate an advanced coal combustor that could be attached to existing coal, oil, and, perhaps, gas-designed boilers. Termed a "slagging combustor" because it removes coal ash in the form of a molten slag, the technology is similar to a unit currently being developed for commercial sale by TRW. A key distinction in the proposed demonstration effort would be the addition of several techniques designed to remove potential sulfur pollutants.

4081 **(IEACR—10) Coal research projects 1988.** (IEA Coal Research, London (UK)). May 1988. 515p. NTIS (US Sales Only), PC A22. Order Number TI89000636/JAW.

The 1988 volume of Coal research projects contains details of nearly 5000 research projects, either in progress or completed in the last three years, on all aspects of coal science and technology throughout the world. Most of the information has been obtained from publicly-available literature rather than from questionnaires. Sources of information include the annual and progress reports of organisations, and other directories of research projects. Some information has also been obtained through direct contact with the organisations carrying out the research. Details of the source of information for individual projects are available on request. Information is presented on mining preparation, transport and handling, properties, processing, combustion, waste management, environmental aspects, products, and health and safety. (CBS)

0103 Preparation

REFER ALSO TO CITATION(S) 4096, 4108, 4119

4082 **(AU/ME—081982) Mathematical modelling of automedium cyclones.** Plitt, L.R.; Flintoff, B.; Turak, A.A. (Alberta Univ., Edmonton (Canada). Dept. of Mineral Engineering). Aug 1982. 61p. (CE—01972). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A sampling program was carried out at a coal processing plant, aimed at obtaining information on the operating characteristics of industrial automedium cyclones, and the collection of bulk samples for use in design of laboratory modeling experiments. The test apparatus and testing procedures were investigated initially with water and later using silica and coal slurries. In the design of the modeling experiments, the principal performance factors considered were: geometrical (design) factors and operational factors (flow rate, solids concentration in feed). This report includes a summary of the results of the silica tests, conducted to provide some measure of the extent to which size classification is suppressed in the cyclone. It was found that the cut size decreased, and the flow split increased, with an increase in the vortex finder clearance. Both the throughput and pressure drop remained unchanged. It was concluded that the performance of the automedium cyclone as a classifier can be considered to follow the model forms constructed for classifying cyclones. 7 refs., 11 figs., 7 tabs.

4083 **(CMRC—82/50-AD) Summary of CMRC's Coal Preparation Program and funding requirements.** Butcher, S.G.; Barron, K. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Jul 1982. 21p. (CE—01977). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The unique characteristics of Western Canadian coals demand specific beneficiation research facilities. Existing facilities are dedicated to wet processing, and complementary facilities are needed for drying research on all types of coals. Such research would help in the development of appropriate beneficiation technology, which would enable coal such as that of the Alberta plains to be competitive in export markets. This report proposes a program of applied research, development and demonstration. Thermal drying is seen as potentially the most effective means of upgrading, and the research proposed is related to the evaluation of the beneficiation potential of Western Canadian subbituminous coals and the practical application of commercially available drying and cleaning systems. The facilities proposed for this research program would also support conventional beneficiation, slurry pipeline and liquefaction programs. 2 figs., 2 tabs.

4084 **(CONF-8609451—1) Control and modelling of coal mills.** Corti, L.; De Marco, A.; Radice, A.; Zizzo, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Jun 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770057/JAW.

From 2. IFAC workshop on modelling and control of electric power plants; Philadelphia, PA, USA (1 Sep 1986).

A mathematical model of a ball mill was developed. The breakage phenomena in the mill as a transport process, based on the concept of breakage velocity. A validation of the results of the model, by means of experimental tests, is also shown. In addition, a control system of pulverized coal mass flow rate in the furnace is described. The system acts both on the feeder and the primary air of mills. The feedback signal of this control loop is an estimation of the pulverized mass flow rate obtained from a simplified model.

4085 **(DOE/PC/79919—4) Flotation and flocculation chemistry of coal and oxidized coals: Technical progress report, June 15, 1988--September 15, 1988.** Somasundaran, P. (Columbia Univ., New York (USA). Dept. of Mineral Engineering). 1988. Contract FG22-87PC79919. 15p. NTIS, PC A03/MF A01. Order Number DE89003312/JAW.

This project is designed to develop an understanding of the fundamentals involved in flotation and flocculation chemistry of coal, and of coal in various states of oxidation. The main objective

of this study is to elucidate mechanisms by which surface interactions between coal and various reagents enhance the benefication of coal. The effect of oxidation on the modification of surface characteristics of coal will also be studied. 1 ref., 7 figs.

4086 **(DOE/PC/90507—T8) Surface properties of coal and their role in coal beneficiation: Technical progress report, 15 June 1988--14 September 1988.** Fuerstenau, D.W. (California Univ., Berkeley (USA). Coll. of Engineering). Oct 1988. Contract FG22-86PC90507. 23p. NTIS, PC A03/MF A01. Order Number DE89003086/JAW.

The main focus of the research is to delineate the wetting characteristics of coal in relation to fine coal processing. As both bulk and surface properties are interrelated and have a controlling role on the performance of these processes, a detailed study was undertaken to correlate their influence on the wetting behavior and response of coal to flotation. The effect of oxidation on the salt flotation response of Cambria {number←sign}78 and New Zealand coals was studied. The flotation yield of the coals was correlated with their mean critical wetting surface tension, total oxygen content and acidic oxygen functional group concentration. A liberation study has also been conducted in order to determine the effect of comminution on the removal of ash from coal. 17 refs., 10 figs., 2 tabs.

4087 **(SLL—1988) An evaluation of oil agglomeration methods in the recovery and beneficiation of the preparation plant waste coal fines from the Prince mine.** Taylor, G.; Court, G. (Scotia Liquicoal Ltd., Dartmouth, Nova Scotia (Canada)). [1988]. 67p. (MICROLOG—88-04578). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Two studies were performed on waste coal fines from the Prince Mine in Nova Scotia. A laboratory study involving wet sieve, float/sink and conventional and non-conventional agglomeration procedures was completed. Based on the laboratory study results, a pilot plant investigation was performed involving conventional and non-conventional pilot scale and bench scale agglomeration methods. The results of the wet sieve and float/sink testing portion of the laboratory investigation served to characterize the feedstock samples. The response of the samples to the agglomeration procedure was then determined. The best results of the laboratory study were achieved using agglomeration followed by newly developed product recovery techniques. For both samples tested, the level of oil addition required was ca 1%; product ash levels were 5-6%. Ash reductions over 87% were achieved. Combustible recoveries were 80% or more. The settings from the optimum laboratory tests were used as the initial conditions for the pilot plant tests. The purpose of the pilot plant investigation was to determine the limiting rates of the various unit operations, to optimize operating technique and to characterize continuous pilot plant operation. The main parameters of interest were slurry solids concentration and shear mixer residence time. The pilot plant phase of this program has confirmed the effectiveness of the agglomeration method in the recovery and beneficiation of preparation plant coal fines from the Prince Mine. 19 figs., 35 tabs.

0104 Processing

REFER ALSO TO CITATION(S) 4111, 4111, 4134, 4143, 4406

4088 **(BNL—41634) Pumping carbon and hydrogen out of the ground using the underground coal hydrogasification HYDROCARB process (UCHG-HCP).** Steinberg, M.; Grohse, E.W. (Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 8p. (CONF-880874—5). NTIS, PC A02/MF A01. Order Number DE89001267/JAW.

From 14. annual underground coal gasification symposium; Schaumburg, IL, USA (15 Aug 1988).

A new concept for UCG is proposed in which underground coal seams are hydrogenated with a hydrogen-rich gas in an injection-well to form a methane-rich production-well gas stream. The exit methane-rich gas stream, is decomposed to carbon black and a hydrogen-rich gas stream above ground. Part of the hydrogen-rich gas stream is withdrawn as a clean product gas and the remainder is recycled underground to, once again, hydrogenate the coal underground. Unlike conventional steam gasification of coal, which is an endothermic process requiring either oxygen or air to combust with coal underground to provide the endothermic heat of reaction, the hydrogenation of coal underground is exothermic which maintains the temperature of the bed in the reaction between the coal and hydrogen to methane. This process thus, in effect, pumps carbon fuel out of the ground with the use of hydrogen. Furthermore, it is a much safer system to operate than the steam-oxygen gasification of underground coal. 2 refs., 2 figs.

4089 **(DOE/CH/10088—T1) Great plains coal gasification plant: Technical lessons learned report.** Delaney, R.C.; Mako, P.F. (Fluor Engineers, Inc., Irvine, CA (USA). Advanced Technology Div.). Nov 1988. Contract AC02-82CH10088. 38p. NTIS, PC A14/MF A01 - OSTI. Order Number DE89003619/JAW.

In a first of a kind, grass roots plant of the complexity of the Great Plains Gasification Plant the lessons learned are numerous and encompass a wide range of items. This report documents the lessons learned from all phases of the project from preliminary design through the most recent operation of the plant. Based on these lessons learned, suggestions are made for changes and/or process improvements to future synfuel plants. In addition, recommendations are made for research and development in selected areas. 46 refs., 31 figs., 33 tabs.

4090 **(DOE/FE/60457—H3) Assessment of coprocessing of coal and residual oil in the Unites States refining industry: Final report.** Schulman, B.L.; Biasca, F.E.; Dickenson, R.L.; Simbeck, D.R. (SFA Pacific, Inc., Mountain View, CA (USA); USDOE Assistant Secretary for Fossil Energy, Washington, DC. Office of Planning and Environment). Sep 1988. Contract AC01-84FE60457. 174p. NTIS, PC A08/MF A01. Order Number DE89002386/JAW.

The coprocessing of coal with petroleum residues provides a route to increase the use of domestic resources---coal and natural gas---to make liquid transportation fuels. The technology for such processing is an application of the residue hydrocracking and coal liquefaction technologies which are well along in development and, in some cases, commercialized. This work examines the status of the new and old technologies, assesses how much coal might be processed in a "grass roots" coprocessing refinery, the extent to which imports of non-Western Hemisphere crudes can be reduced, and a rough estimate of the costs of making light fuels from coprocessing. The work also extends the concepts and strategies to see how a coprocessing technology can be initiated as an "across the fence" venture adjacent to an existing refinery. In addition, the costs of producing methanol from coal and gas are compared. 13 figs., 22 tabs.

4091 **(DOE/MC/21046—2594) An engineering evaluation of environmental data from the KRW Coal Gasification Process Development Unit: Topical report.** Scheffel, F.A.; Skinner, F.D. (Radian Corp., Austin, TX (USA)). Jan 1988. Contract AC21-84MC21046. 179p. NTIS, PC A09/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010250/JAW.

Based on the sampling and analysis program conducted by Radian at the KRW PDU in July 1985: Hydrogen sulfide was the predominant sulfur species present in the hot product gas. Approximately 95% of the gaseous sulfur measured was present as H_2S, while the remaining 5% consisted of carbonyl sulfide (COS). Dolomite injection had a major impact on the distribution of sulfur between the gas and solid streams. Without dolomite injection, about 20% of the sulfur entering with the coal was found in the various solid streams leaving the gasifier (i.e., ash, tertiary cyclone solids, and hot gas particulates) and 80% was present as H_2S and COS in the hot gas prior to quench. When dolomite was injected into the gasifier bed, the distribution was essentially reversed; about 70% was found in the solids and 30% in the hot gas. The primary reduced nitrogen species found in the hot product gas were ammonia and hydrogen cyanide. For most of the trace elements measured, 95 to over 99% of the inlet mass was distributed to the outlet solid streams. The KRW process produces very low levels of organics.

The composition of the hot product gas from the KRW PDU was similar to that from other non-tar producing gasifiers. Cleanup of the hot product gas would be required to reduce the concentrations of particulate matter, sulfur species, trace elements, and possible nitrogen species and carbon dioxide. If the KRW gasifier product gas were to be used in an integrated gasification/combined cycle (IGCC) power plant, such as the proposed Appalachian project, it would be advantageous to use gas cleanup technologies that minimize the removal of carbon dioxide, and keep the gas temperature as high as possible. 19 refs., 2 figs., 12 tabs.

4092 **(DOE/MC/22146—2581) KILnGAS Commercial Module RAM IIA engineering analysis report: Topical report.** (Allis-Chalmers Coal Gas Corp., Alton, IL (USA)). Jan 1988. Contract FC21-85MC22146. 116p. NTIS, PC A06 - OSTI. Order Number DE88001085/JAW.

The findings of the RAM IIA Engineering Analysis were used to identify refinements needed in the KILnGAS process for commercial applications. It was concluded that as a result of RAM IIA testing, substantial progress has been made in demonstrating the potential of the KILnGAS process. There are no longer any gasification issues that would be considered a high commercial risk. A majority of the refinements needed now are of a design nature rather than technology-oriented. A summary of the refinements, 25 in number, is shown in Table 1, KILnGAS Technical Status. Each of these was placed in one of three categories: Gasification Technology, the refinement requires additional evolvement of the gasification process for reasons such as performance or repeatability. Process Design, these involve design improvements or are needed so that commercial design of other portions of the process can be undertaken. Equipment Design, these require mechanical or electrical design improvement to enhance performance or availability, fundamental configurations having already been demonstrated. This report contains 15 sections. Each includes a description of an individual area of the KILnGAS process, its status at the conclusion of RAM I, a summary of improvements introduced for RAM IIA, an analysis of the RAM IIA results, and conclusions and recommendations. 36 figs., 6 tabs.

4093 **(DOE/MC/22146—2602) KILnGAS RAM IIB final technical report: Topical report.** (Allis-Chalmers Coal Gasification Corp., Milwaukee, WI (USA)). Apr 1988. Contract FC21-85MC22146. 236p. NTIS, PC A11/MF A01 - OSTI; 1; GPO Dep. Order Number DE88010265/JAW.

RAM IIB was part of a continuing Reliability, Availability, and Maintainability (RAM) program, the purpose of which is to demonstrate the KILnGAS technology. RAM IIB began in March 1987 and concluded in April 1988, and was preceded by RAM I and RAM IIA. These prior segments including engineering to design and incorporate improvements in the KILnGAS Commercial Module (KCM), and were followed by demonstration tests. RAM IIB, by contrast, was primarily engineering-oriented. In-depth engineering analysis of RAM IIA test results was performed during RAM IIB. It was concluded that substantial progress had been made as a result of RAM IIA testing, and that previous unknowns relative to commercial risks had been greatly reduced. These findings provided the basis for identifying future development needs and the KILnGAS Technical Committee issued a report providing commercial improvement recommendations. The majority of the recommendations were design-related since prior technology-oriented issues had now been largely answered. Preliminary designs were developed for four KCM improvements that could be used in commercial applications as well. These were: improved air-steam porting, recycle of carbon losses, a more reliable ash-discharge system, and improved gasifier dust seals. Each of these was a factor in limiting either KCM availability, gas production, or conversion efficiency during RAM IIA. A "first plant" KILnGAS-based commercial plant concept was developed for a Gasification Combined-Cycle (GCC) application. Performance features, capital investment, and power generation costs were developed for a 400 MW plant. Since RAM IIB did not include an operational phase, the KCM was placed in a "protected" condition, and periodic maintenance was performed to assure restart capability. 33 figs., 6 tabs.

4094 **(DOE/MC/23077—2627) Engineering support services for the DOE/GRI Coal Gasification Research Program: Quarterly report, September 26, 1987--December 25, 1987.** Mazzella, G. (Foster Wheeler USA Corp., Clinton, NJ). 1987. Contract AC21-86MC23077. 61p. NTIS, PC A04/MF A01. Order Number DE88010288/JAW.

During the current period, KRW conducted two test runs in their 20 TPD fluidized-bed gasifier PDU. One of the objectives in the hot gas cleanup test program was to demonstrate the proof-of-concept for external desulfurization by zinc ferrite. Success criteria included removal of H_2S and COS to less than 50 ppmv, achieving greater than 50% zinc ferrite utilization, and operation over 5 to 10 cycles of controlled regeneration. The intent was to characterize the zinc ferrite performance under the projected commercial operating conditions of 2 fps linear velocity, inlet dust loading from zero with a barrier filter to about 1000 ppM with a high efficiency cyclone, and a fuel gas having a heating value greater than 110 BTU/SCF on a wet basis. Performance data obtained are summarized. Work continued on the evaluation of modular integrated coal gasification combined cycle (IGCC) power systems based on entrained flow gasification of Illinois No. 6 bituminous coal. In addition, analysis of the Phase-2 test data, obtained by IGT in their high pressure fluidized-bed gasifier PDU, was continued. Details of the status of the IGCC evaluation and the IGT data analysis studies are included. 5 refs., 7 figs., 24 tabs.

4095 **(DOE/PC/70779—16) Studies of metal/carbon surface chemistry: Final report, September 1, 1984--August 31, 1987.** Koel, B.E. (Colorado Univ., Boulder (USA). Dept. of Chemistry). 25 May 1988. Contract FG22-84PC70779. 9p. NTIS, PC A02/MF A01 - OSTI; 1; GPO Dep. Order Number DE88011264/JAW.

The purpose of this research is to identify stable surface species formed from molecular adsorption and reaction on metal/carbon surfaces. This research has practical application in improving the fundamental understanding of catalytic coal gasification. Well-defined model catalysts for carbon gasification have been studied by vapor depositing alkali and transition metal atoms on carbon surfaces. Vibrational spectroscopy using HREELS and photoelectron spectroscopy of these surfaces are being used to develop an atomic-level understanding of the chemical bonding, structure, and reactivity of the metal/carbon surface and of the adsorbed molecular species.

4096 **(DOE/PC/79806—5) Characterization and suitability of superclean coals for hydroliquefaction feedstocks: Technical progress report for the period of July 1--September 30, 1988.** Kim, Nam K. (Michigan Technological Univ., Houghton (USA). Dept. of Chemistry and Chemical Engineering). 5 Oct 1988. Contract FG22-87PC79806. 29p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003670/JAW.

Superclean coals have been produced from the PDU of the static tube flotation columns. Pittsburgh #8 coals (7% ash) were used for the demonstration run, and five coals with ash concentrations ranging from 3%--43% were prepared by the virtue of flotation. The roles of successively increasing ash content in hydroliquefaction are discussed. Hydroliquefaction of coals has been carried out with tetralin as donor solvent in one liter Parr autoclave. Preliminary results indicate that high ash contents favor the formation of certain compounds. 5 refs., 13 figs., 6 tabs.

4097 **(DOE/PC/80912—T8) Ambient temperature liquefaction using liquid clathrates: Final technical report.** Atwood, J.L. (Alabama Univ., University (USA). Dept. of Chemistry). 22 Jun 1988. Contract FG22-85PC80912. 6p. NTIS, PC A02/MF A01. Order Number DE88013494/JAW.

New air-stable liquid clathrates based on simple salts were used to effect liquefaction. The quantity of the liquefied products from the liquid clathrates based on [organic base{center←dot}H]$^{+-}$[Cl-H-Cl]/sup minus/ is among the highest yet observed. Indeed, liquid clathrates based on classic room temperature molten salts such as [pyridinium][$AlCl_4$] have afforded yields of liquid material which may go as high as 70%. The work-up scheme for the

[NBu_4][Cl-H-Br] liquefaction products has afforded excellent mass balance. The first model hydrogenation runs in a liquid clathrate have been successfully carried out. In the liquid clathrate based on [NBu_4][BF_4] and benzene, Wilkinson's catalyst has given almost complete conversion of cyclohexene to cyclohexane. Studies on the retention of cyclohexene and cyclohexane in the liquid clathrate phase are in progress. Initial indications are that cyclohexene is more compatible with the lower liquid layer than is cyclohexane.

4098 **(EMR—SFA1983) Synthetic fuels from coal-heavy oil mixtures. Phase 1. A survey of the work applicable to coal bitumen mixtures as synthetic fuels feedstock.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Jan 1983. 8p. (MICROLOG—88-04574). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

This paper presents a review of significant research and development being performed worldwide that is applicable to the coconversion of coal and bitumen to synthetic liquid fuels. Coal liquefaction processes are outlined as historical background. The process that is being sought by this review is one that combines the processing of coal and bitumen to produce a synthetic crude oil, notably one in which bitumen serves as the slurry medium for coal. Research in Canada, the USA, Europe, and Japan is summarized. Major current efforts are the Alberta Research Council program using bitumen and heavy oil, and the Auburn University/Cities Service program using oil refinery streams as feedstocks with coal. 17 refs., 2 tabs.

4099 **(EMR/ER—88-20TR) Bibliography of CANMET publications on coprocessing.** (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). Mar 1988. 46p. (MICROLOG—88-04571). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Coprocessing refers to the processing of mixtures of coal and oil (heavy oil and bitumens) with the objective of liquefying the coal and upgrading the oil simultaneously. This bibliography has been prepared to provide a one-source reference to the reports and publications generated to date at the Canada Centre for Mineral and Energy Technology on coprocessing technology. All entries are listed chronologically under each major subheading by type of publication: refereed journals, research reports and conference proceedings, confidential laboratory reports, oral presentations, and contract final reports. Each entry includes a brief abstract highlighting significant aspects. 102 refs.

4100 (EUR—11150-DE,EN,FR, pp 1-9) **Pyrolysis and hydropyrolyis of coal in a cyclone reactor.** Lebrun, A.; Houzelot, J.; Villermaux, J.; Bertau, M.; Sauffrey, M. (Laboratoire des Sciences du Genie Chimique - CNRS - ENSIC, Nancy (France)). 1987. (In French). Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

This report presents the aims of the investigations, which were to develop a new method of coal pyrolysis producing more volatile matter than conventional pyrolysis in coke ovens. Sets forth the reasons for selecting the cyclonic reactor (simultaneous reaction and separation of semi-coke and VM, more efficient heat transfer and short residence time). Describes the experimental installation, the working principles, operating conditions and initial results obtained. Concludes that rapid pyrolysis of coal in a cyclone reactor is possible, but remains an extremely delicate operation (complex hydrodynamics) and that intensive control of the operating conditions is needed if the process is to be successful. 30 refs., 2 figs., 1 tab.

4101 (EUR—11150-DE,EN,FR, pp 11-24) **Changes in active specific surface and size of semi-coke crystallites during hydropyrolysis.** Braekman-Danheux, C.; Planchon, D. (Universite Libre de Bruxelles (Belgium). Service de Chimie Generale et de Carbochimie). 1987. (In French). Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

The capacity of semi-coke from hydropyrolysis for the chemical absorption of oxygen was measured at 110/sup o/C and at 0.1 MPa air. This provides a relative indication of the concentration of carbon in active sites. During hydropyrolysis the active surface develops like the specific surface: with the introduction of hydrogen it increases, reaching a maximum towards 55% by weight of conversion, and then gradually diminishes during the slow methanation stage. Measurement of the active surface has shown the importance of the role played by the active sites in coal-gasification reactions. Active-surface values have been successfully compared with the corresponding reaction speeds, providing a 'real' speed constant which is dependent solely on temperature. The presence of oxygen promotes the growth of carbon crystallites. At constant pressure and temperature the speed of growth progresses linearly as a function of the reaction time. There is no direct link between the size of the crystallites and the reactivity of the semi-coke. 6 refs., 3 figs., 3 tabs.

4102 (EUR—11150-DE,EN,FR, pp 25-38) **Study of the rheological behaviour of a non-coking coal when carbonised under hydrogen pressure.** Laurent, P. (Universite Libre de Bruxelles. Service de Chimie Generale et de Carbochimie). 1987. (In French). Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

As part of an investigation into the hydropyrolysis of a non-coking coal from Beringen colliery, and after analysing by optical microscopy the morphological development of the semi-coke produced during an analysis was undertaken this process, of the rheological properties of the coal when carbonised under hydrogen pressure. Dilatometer measurements carried out to a pressure of 3 MPa hydrogen failed to reveal any swelling of the sample. The experiments did show, however, that the contraction and softening temperature of the coal were more sensitive to variations in pressure, firing rate and particle size than to the reaction atmosphere. Tests carried out using a Gieseler plastometer, on the feedstock coal and on the samples pretreated at hydrogen pressure, yielded no measurable fluidity under the conditions investigated: however, the modification of particle shape observed by optical microscope and the appearance of a fine mosaic structure in the semi-coke from hydropyrolysis leads us to assume a certain degree of plasticity. Development of a relative caking index has also served to represent the effect of the hydrogen on coal agglomeration during carbonisation under pressure.

4103 **(EUR—11150-DE,EN,FR) Round-table meeting 'chemical and physical valorization of coal'.** (Commission of the European Communities, Luxembourg). 1987. 125p. (In English, French or German). (CONF-8706357—). Commission of the European Communities, Luxembourg.

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

A total of 7 papers was presented at the meeting. The papers have the following titles: pyrolysis and hydropyrolysis of coal in a cyclone reactor; changes in active specific surface and size of semi-coke crystallites during hydropyrolysis; study of the rheological behaviour of a non-coking coal when carbonised under hydrogen pressure; thermo-analytical methods for investigating the volatiles content of bituminous coal; total reflection distribution of coal and associated technical properties; solid-state techniques for coal characterisation; the mode of ocurrence and behaviour of salt minerals in bituminous coals. Each paper has been abstracted separately.

4104 **(INIS-mf—11803) Prototype plant for nuclear process heat (PNP) - operation of the pilot plant for hydrogasification of coal. Final report.** Bruengel, N.; Dehms, G.; Fiedler, P.; Gerigk, H.P.; Ruddeck, W.; Schrader, L.; Schumacher, H.J. (Rheinische Braunkohlenwerke A.G. (RBW), Koeln (Germany, F.R.). Abt. Forschung und Entwicklung; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1988. 246p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88755403/JAW.

The Rheinische Braunkohlenwerke AG developed the process of hydrogasification of coal in a fluidized bed for generation of SNG. On basis of test results obtained in a semi-technical pilot plant of a through-put of 250 kg/h dried coal a large pilot plant was erected processing 10 t/h dried brown coal. This plant was on stream for about 14700 h, of which about 7800 h were with gasifier operation; during this time about 38000 t of dried brown coal of the Rhenish district were processed containing 4 to 25% of ash. At pressures of 60 to 120 bar and temperatures of 800 to 935/sup 0/C carbon conversion rates up to 81 percent and methane amounts of 5000 m/sup 3/ (STP)/h were reached. The decisive parameter for methane generation was the hydrogen/coal-ratio. Even at high moisture contents, usually diminishing the methane yield from the coal essentially, by high hydrogen/coal-ratios high methane yields could be obtained. The gasifier itself caused no troubles during the total time operation. Difficulties with the original design of the residual char cooler could be overcome by change-over from water injection to liquid carbon dioxide. The design of the heat recovery system proved well. Alltogether so the size increasement of the gasifier from the semi-technical to the large pilot plant as well as the harmonization of gas generation and gas refining was proved. (orig.) With 20 refs., 20 tabs., 81 figs.

4105 **(NP—9770021) Methanation of CO/sub 2/-rich gases. Final report.** Hedden, K.; Kaltenmaier, K. (Karlsruhe Univ. (T.H.) (Germany, F.R.). DVGW-Forschungsstelle am Engler-Bunte Institut; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1988. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770021/JAW.

The conversion of carbon dioxide and hydrogen was investigated using nickel catalysts developed for the methanation of CO/H/sub 2/-mixtures. The pressure range varied from 15 up to 76 bar and the temperature was in between 400 and 520/sup 0/C. The catalysts showed less deactivation when contacted with a synthesis gas containing CO/sub 2/ instead of CO. On the fresh catalyst CO/H/sub 2/ was converted faster than CO/sub 2//H/sub 2/, but after a time on stream of 80 hours the reverse was detected. For two selected catalysts, at a stable activity, kinetic data have been measured for the conversion of CO/sub 2//H/sub 2/-mixtures. The results were fitted to a power rate law giving reaction orders of 0.7 and 0.9 for carbon dioxide and 0 for hydrogen. The shape of CO-selectivity versus modified residence time indicated, that the CO/sub 2/-methanation can be described as a consecutive reaction. According to this model CO/sub 2/ first is converted to CO. The intermediate carbon monoxide then forms methane with hydrogen. Integral kinetic data, that means yield versus gas/catalyst contact time could be described sufficiently using rate equations in which the inhibiting effect of carbon monoxide on the reverse water gas shift reaction was taken into account. These studies were performed to get design data for the methanation of coke oven gases. It could be proved that the surplus of hydrogen in coke oven gas can be converted to methane by adding carbon dioxide. (orig.) with 146 refs., 13 tabs., 81 figs.

4106 **Sequential and nonsequential process data coaptation.** Prasad, B.V.R.K.; Kuester, J.L. (Dept. of Chemical Engineering, Arizona State Univ., Tempe, AZ (US)). *Industrial and Engineering Chemistry Research;* **27**: No. 2, 294-303(Feb 1988).

Two process coaptation approaches, sequential and nonsequential, for data adjustment and estimation were investigated for a microcomputer implementation for an indirect liquefaction process. The steady-state Kalman filter, a sequential estimator, was found to be suitable for on-line process flow data estimation. The technique also serves as a means to carry out integration of the process data. The integrated data, free of systematic errors, could be used by the nonsequential technique. A reduced balance approach, using optimization routines, was needed for the nonsequential data coaptation problem. Adjustment of the composition variables and calculation of the process model parameters that satisfy material balance constraints are the principle benefits of the optimization approach. Several gross measurement error detection schemes, reported in the literature, were also tested for their suitability to the two techniques.

0106 Properties

REFER ALSO TO CITATION(S) 4085, 4086, 4096, 4122, 4136, 4803, 4818

4107 **(CONF-8809162—1) Advanced research in instrumentation and control technology.** Raptis, A.C.; Sheen, Shuh-Haw. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01. Order Number DE89000598/JAW.

From Advanced Research and Technology Development (AR&TD) direct utilization, instrumentation, and diagnostics contractors review meeting; Pittsburgh, PA, USA (6 Sep 1988).

The objective of the project is to develop an ultrasonic viscometer for online monitoring of coal/liquid slurries. The analytical investigation performed during this reporting period is for (1) better understanding of coal-slurry rheological properties, (2) experimental evaluation of proposed ultrasonic techniques for viscosity measurement, and (3) selection of a promising technique for further development. Coal slurries of high particle concentration often exhibit non-Newtonian flow behavior, i.e., the slurry viscosity varies with shear rate. Moreover, the slurry viscosity is also a function of temperature, chemical composition, and particle concentration and size distribution. Therefore, direct online measurement of the coal-slurry viscosity is of importance to diagnostics and control of the slurry flows. Results are briefly discussed.

4108 **(DOE/PETC/TR—88/4) The development of an automated image analysis method to estimate pyrite particle liberation in crushed coal.** Irdi, G.A.; Rohar, P.C.; Chaparro, L.F. (USDOE Pittsburgh Energy Technology Center, PA. Coal Preparation Div.; Pittsburgh Univ., PA (USA). Dept. of Electrical Engineering). Jul 1988. 17p. NTIS, PC A03/MF A01 - OSTI; 1; GPO Dep. Order Number DE88014876/JAW.

An automated image analysis (AIA) program was developed and tested for its reliability to estimate pyrite particle degree of liberation in crushed coals. Tests showed that the degree of liberation program gave acceptable results when compared to manually acquired data. The degree of liberation data will be used in conjunction with pyrite particle size distribution data to develop a predictive method for pyritic sulfur reduction. 9 refs., 9 figs.

4109 (EUR—11150-DE,EN,FR, pp 39-58) **Thermo-analytical methods for investigating the volatiles content of bituminous coal.** Kettrup, A.; Ohrbach, K.-H.; Matuschek, G. (Universitaet GH, Paderborn (Germany, F.R.). Fachbereich 13, Angewandte Chemie). 1987. (In German). Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

A thermo-analysis/mass spectrometry coupling system was used to investigate German coal samples of different rank. This combination device enabled the thermo-analysis and mass spectra data to be recorded simultaneously both under normal pressure in various gas atmospheres and in a high vacuum. The thermo-analysis curves were used to determine the mass loss in the relevant temperature ranges, the temperature values of the thermal effects and the temperatures of the maximal matter exchange rates. A comparison of the temperature-dependent mass spectra shows that running at a high vacuum produces spectra with an extremely high fragment content. In air, products of oxidation were identified exclusively, in contrast to the experiments carried out in an argon atmosphere. A micro-computer system was used to control the quadrupole mass spectrometer, to store the mass spectra and to provide a graphic display. The necessary software was developed in-house as part of the research project. The standard arrangement of the combined device usually only features one recording unit for simultaneous recording of twelve pre-selected ionic current intensities with varying or constant measurement parameters. 12 refs., 10 figs., 3 tabs.

4110 (EUR—11150-DE,EN,FR, pp 59-91) **Solid-state techniques for coal characterisation.** Burchill, P.; Dunstan, B.; Mitchell, C.A.; Martin, T.G. (British Coal, Stoke Orchard (United Kingdom). Coal Research Establishment). 1987. Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

Solid-state techniques have yielded direct information on the chemical environment of sulphur, nitrogen, carbon, oxygen, sodium and aluminium in coals. The methods described, which include solid-state ^{23}Na, ^{27}Al and ^{13}C NMR spectroscopy, diffuse reflectance Fourier-transform infrared (FTIR) spectroscopy, X-ray photoelectron spectroscopy, scanning electron microscopy in conjunction with energy-dispersive X-ray analysis (SEM-EDX), temperature programmed reduction (TPR) and thermal analysis, generally require little sample preparation. The results should be highly representative of the whole coal, although care must be exercised in making assumptions about the bulk coal on the basis of data obtained by surface-specific spectroscopic techniques.

4111 (EUR—11150-DE,EN,FR, pp 93-106) **Total reflection distribution of coal and associated technical properties.** Steller, M. (Bergbau-Forschung GmbH, Essen (Germany, F.R.)). 1987. Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

A method has been developed and tested for assessing the hydrogenation capacity and coking power from the total reflection distribution of all macerals in a coal sample for the texture-analysis system. The total reflection distribution of coal provides reliable information on the degree of transformation during hydrogenation. Here the same reactivity is assigned to macerals of similar reflection. It is possible to separate the reactive zones from the inert. When assessing the coking power of coal, of the parameters investigated (coke yield capacity, volatile matter, mean vitrinite reflection, M-40 and M-10) only the last two can be correlated with the total reflection distribution. 13 figs., 1 tab.

4112 (EUR—11150-DE,EN,FR, pp 107-122) **The mode of occurrence and behaviour of salt minerals in bituminous coals.** Hodges, N.J.; Marsh, M.K.; Martin, T.G. (British Coal, Stoke Orchard (United Kingdom). Coal Research Establishment). 1987. Commission of the European Communities, Luxembourg. (CONF-8706357—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (10 Jun 1987).

Three bituminous coals, selected on the basis of their varying ionisable salt content have been analysed, their minerals identified and their salts quantified. Typically, the bulk of the minerals fall within the groups, aluminosilicates, sulphides, carbonates and silicates. The salts exist mainly as ions (Na^+, K^+, Ca^{2+}, Mg^{2+},Cl^-,SO_4^{2+}) distributed about the coal surface; they may be substantially removed by water leaching, the ease of removal being controlled by the nature of the porous structure of the coal. As the salt content of the coals decreases, so the melting temperature of their ashes increases. 2 refs., 1 fig., 9 tabs.

4113 **(PNL-SA—16363) Analysis of biodegraded coals.** Bean, R.M.; Campbell, J.A.; Franz, J.A.; Linehan, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 16p. (CONF-8810170—3). NTIS, PC A03/MF A01. Order Number DE89002357/JAW.

From DOE direct liquefaction contractor's conference; Pittsburgh, PA, USA (4 Oct 1988).

It is now clear that a number of microorganisms have the ability to produce enzymes that will act to break down the structure of coal and, in many cases, render it water soluble. There are a number of potentially important commercial applications for this newly recognized process in nature: (1) recovery and utilization of thin seams of coal near the surface, as well as coal surface refuse, which, because of low heating value, have been uneconomical to recover or to burn; (2) a feedstock for further microbial desulfurization, denitrogenation, or demineralization; and (3) a feedstock for anaerobic digestion of coal to produce methane gas. Methods are needed to characterize the chemical nature of the solubilized product and determine the types of reactions taking place during the biosolubilization process. The objective of research at PNL is to develop new methods, and adapt existing methods, for characterizing biodegraded coals. In this paper, we describe the application of gel permeation chromatography (GPC) and ^{13}C nuclear magnetic resonance (^{13}C NMR) to the characterization of oxidized coals, their base solubilized products, and their microbial solubilization products. 6 refs., 1 fig., 9 tabs.

0108 Waste Management

REFER ALSO TO CITATION(S) 4094, 4133, 4243, 4412

4114 **(CONF-881120—11) New method for carbon dioxide recovery from the combustion of fossil fuel.** Berry, G.F.; Wang, C.S.; Dennis, C.B.; Wolsky, A.M. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01. Order Number DE89000545/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

The relative size and composition of gas streams concomitant with a new method of carbon dioxide recovery are described and related to each other. This is done for two variations, dry recycle and wet recycle, of the new method. Calculations performed under the differing assumptions of complete combustion and chemical equilibrium are compared. The following fuels are considered: methane, CH_4; Wyodak Coal, CN/sub 0.013/H/sub 1.675/O/sub 0.606/S/sub 0.004/; and Black Thunder Coal, CN/sub 0.019/H/sub 1.559/O/sub 0.539/S/sub 0.003/. The purity of carbon dioxide from the system exit, the recycle fraction of combustion products, the oxygen concentration at the furnace inlet and outlet, and the excess oxygen at the furnace inlet are investigated. 9 refs., 8 figs., 4 tabs.

4115 **(DOE/PC/79921—T4) Pore structure and reactivity changes in hot coal gas desulfurization sorbents: Technical progress report, April 1988--June 1988.** Sotirchos, S.V. (Rochester Univ., NY (USA). Dept. of Chemical Engineering). Jul 1988. Contract FG22-87PC79921. 17p. NTIS, PC A03/MF A01. Order Number DE89002270/JAW.

This quarterly report presents technical progress achieved during the second calendar quarter of 1988 on the investigation of pore structure and reactivity changes in metal/metal oxide sorbents for desulfurization of hot coal gas. The primary objective of the project is the investigation of the structural and reactivity changes occurring in metal/metal oxide sorbents used for desulfurization of hot coal gas during sulfidation and regeneration, with particular emphasis placed on the effects of these changes on the sorptive capacity and efficiency of the sorbents. The following tasks have been identified in the project: Conversion vs Time Studies during Sulfidation and Regeneration; Pore Structure Evolution Studies during Sulfidation and Regeneration; Intraparticle Diffusion Studies; Development of Structural Models for Hot Coal Gas Desulfurization Sorbents; and Development of Mathematical Models for Fixed-Bed Desulfurization Reactors. Research efforts primarily focused on Tasks 1 and 5. A summary of the work done follows. 10 refs., 4 figs.

4116 **(DOE/PC/91022—T1) Acoustic agglomeration of power plant fly ash for environmental and hot gas cleanup: Final report.** Reethof, G.; Koopmann, G.H. (Pennsylvania State Univ., University Park (USA). Environmental Resources Research Inst.). Aug 1988. Contract AC22-86PC91022. 361p. NTIS, PC A16/MF A01. Order Number DE88015254/JAW.

Research on acoustic agglomeration is presented. Areas addressed include: basic investigations of acoustic agglomeration; improvement in the acoustic agglomeration model; testing in Penn State's Facilities; high efficiency siren research. (CBS)

4117 **(EPRI-CS—5981-Vol.1) Fly ash construction manual for road and site applications: Volume 1: Specification guidelines: Final report.** Glogowski, P.E.; Kelly, J.M.; Curry, M.A. (Electric Power Research Inst., Palo Alto, CA (USA); GAI Consultants, Inc., Monroeville, PA (USA)). Oct 1988. 121p. Unlimited audience, publicly available. Rsearch Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002434/JAW.

This two-volume manual presents information for the specification writer or contractor planning to use coal fly ash in the following applications: Fills, Embankments, and Backfills; Subgrade Stabilization; Pavement Base Course; Slurry Backfill; Soil Amendment; Volume 1, "Specification Guidelines", contains guidelines for preparing construction specifications for each of the above uses. Volume 2, "Contractor's Guide", contains information directed toward contractors that describes equipment selection criteria and proper construction techniques. Sample specifications are included as appendices to each volume. This manual is presented as a supplement to the two volume design manual, Fly Ash Design Manual for Road and Site Applications, Volume 1: Dry or Conditioned Placement and Volume 2: Slurried Placement (EPRI CS-4419). 21 refs., 1 fig.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 4089, 4243

4118 **(ECE—EB.AIR/14) National strategies and policies for air pollution abatement.** (United Nations, Geneva (Switzerland). Economic Commission for Europe). 1987. 60p. United Nations, Geneva (Switzerland). Economic Commission for Europe.

This report presents the results of the 1986 major review of national strategies and policies for combating air pollution prepared within the framework of the convention on Long-Range Transboundary Air Pollution. National policy measures are discussed under the headings: legislation and regulatory provisions; economic incentives and disincentives; and required control technologies. They include ambient air quality standards, fuel quality standards, fuel tax measures, emission charges and fines and technology requirements in environmental legislation, among others. Also discussed are national and local authorities: responsibilities and co-ordination; monitoring systems for air quality and air pollution effects; integrated assessment of costs and benefits in national decision-making; the role of research and development; activities within the Executive Body of the Convention; other bilateral and multilateral activities in the ECE region; and global aspects and concerns. Country-by-country emission figures are tabulated, as are figures for energy consumption and energy mix.

4119 **(EPS—8510) Report on the characterization of particulate and gaseous emissions from the coal-fired coal dryer at Bullmoose Operating Corporation, Tumbler Ridge, British Columbia.** Cianciarelli, D.; Capowski, R. (Environment Canada, Ottawa, Ontario. Environmental Protection Service). Oct 1985. 89p. (CE—01952). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A series of tests at a coal preparation plant in British Columbia were conducted to characterize the particulate and gaseous emissions from an environmentally controlled, coal-fired thermal dryer and to evaluate sampling methodologies for the identification of trace organic emissions. Stack samples were collected to determine the emissions of particulates, selected heavy metals, gaseous HCl and trace organic compounds. Stack gas concentrations were also analyzed on a continuous basis for SO/sub 2/, nitrogen oxides, CO, total hydrocarbons and oxygen. No problems were experienced due to the polyaromatic hydrocarbon (PAH) compounds in PAH/PCB train, distribution data indicated good adsorption efficiency by the XAD-2 absorbent and effective rinsing procedures. No PAHs were detected in the condensate trap, indicating good percolation efficiency. All blank train samples, reagent and resin blanks contained sub-detectable levels of PAHs. In the case of PCBs, however, the results should be regarded as inconclusive due to the comparatively high levels of PCBs found in the blank train. Considering the complexity and different charecteristics of the organic compounds analyzed, the organic sampling train was effective for collecting dioxins, furans and polyaromatic hydrocarbons. 7 figs., 31 tabs.

4120 **(IMSRP—I) Crops and coal - Illinois Mine Subsidence Research Program.** (Illinois State Geological Survey, Champaign (USA)). 1988. 20p. Illinois State Geological Survey, Champaign (USA).

The Illinois Mine Subsidence Research Program (IMSRP) involves three-way collaboration between Illinois' two major industries, agriculture and coal' and scientists from all over the state. It is specifically concerned with active mines using high-extraction and room-and-pillar techniques. The aim is to determine how subsidence affects farmland and to develop guidelines for mitigation or repair. This report describes the beginning of IMSRP and the research being carried out within the program. This includes study of the subsidence process, rock characterisation and floor studies. Each type of IMSRP research has been coupled with an extensive database management program and the findings of the research will be disseminated via publications and technical seminars and workshops.

4121 **(NECL—8506) Phosphorus from operating surface coal mines.** (Norecol Environmental Consultant Ltd., Vancouver, British Columbia (Canada)). Jun 1985. 67p. (CE—01970). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Review of literature pertaining to phosphorus in soils indicates very complex interactions between geology, soil moisture and texture, chemical constituents and plants that enter into determination of the phosphorus cycle. Soil phosphorus is found in various forms, including soil solution phosphorus, which is readily adsorbed by plants or may be removed in groundwater. Soil solution phosphorus concentrations are maintained in equilibrium by adsorption or desorption of P from soil particles. Literature on P found in surface water indicates that a certain amount of P is exported from undisturbed watersheds and may be enhanced as alterations occur within the watershed. Most such P export occurs in association with particulate materials. In soils, orthophosphate is the type of P used by plants; at a coal mine site in British Columbia, elevated orthophosphate was discovered in mine discharge waters but was not detectable after dilution in receiving waters. Both dilution or adsorption processes may have been at work. Phosphorus is deposited in land or water environments from the atmosphere; retention of this source of P in forested watersheds is ca 95%. Introduction of P in this way may be a significant source to headwater or slow flushing lakes. Potential phosphorus sources from surface coal mines to the aquatic environment are identified as: disturbed, unvegetated ground; fresh rock cuts or waste rock; unvegetated soil stockpiles; active, fertilized reclamation areas; haul roads and plant sites; sewage treatment facilities; diversion/interceptor ditch discharges; and groundwater. 79 refs., 1 fig., 3 tabs.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 4143, 4148

4122 **(ARC—8211) Alberta Plains coal regions: potential feedstock for coal conversion by liquefaction and pyrolysis.** Campbell, J.D.; du Plessis, M.P. (Alberta Research Council, Edmonton (Canada)). Nov 1982. 32p. (CE—01953). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Coal, believed to be suitable as feedstock for on-site conversion plants, occurs in a number of very large deposits in the Alberta Plains; some of these deposits are difficult to access, others are already dedicated to thermoelectric power production, but many remain uncommitted. This report serves as a guide to those coal deposits that are both suitable and available for conversion process. It is believed that, under conditions foreseeable for the near future in Alberta, the preferred feedstock for on-site coal conversion process

will be subbituminous coal; liquefaction and pyrolysis will be the dominant processes. This report describes 15 coal regions in the Alberta Plains, all of which are easily accessible, possess already-developed social infrastructure and contain adequate reserves of subbituminous coal recoverable by current mining technology, to support one or more process plants. None of them presents insurmountable problems of use-conflict with agriculture, recreation or ecologically fragile environments. Of these, nine are believed to be eminently suited to liquefaction process industry, containing adequate reserves and not being dedicated at present to power generation. The remaining six regions, while not specifically excluded from liquefaction, are probably more suitable for power generation and in some cases are already dedicated to that use. These six are worth considering as sites for mated power/pyrolysis industry. 3 refs., 1 fig., 2 tabs.

4123 (SEGJ—8801, pp 59-61) **PS logging by the penetration detector. Application to peat layer.** Okuzumi, Koichi; Kitsunezaki, Choro. (Akita Univ., Mining College, Akita, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A penetration detector which is penetrated into ground through a rod was manufactured trially. A soft peat layer was selected as the test site and operative problems were experimentally studied. Then, some dynamic investigations were made concerning the consolidation effect on the basis of the obtained velocity distributions on P wave and S wave. The trial penetration detector consisted of metallic press-in pipe, plastic cushion tube and detector. It was found from the test results that PS logging with the penetration detector was sufficiently effctive. But the cutt-off effect of pipe vibration due to the cushion tube was not sufficient to Z direction. The relationship between the uniaxial compressive strength q and S wave velocity V variated greatly in sandy silt layer under the peat layer, so that $V=1.41*q$ formula could be obtained by assuming a linear relation in the peat layer except sandy silt layer. (6 figs, 2 refs)

0120 Mining

REFER ALSO TO CITATION(S) 4120, 5078

4124 **(CMRC—83/14-T) Estimated surface mining costs of raw coal prior to beneficiation.** Wright, P.L. (Coal Mining Research Centre, Edmonton, Alberta (Canada)). Mar 1983. 12p. (CE—01962). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This paper was prepared to provide order-of-magnitude costs of mining, loading and hauling of raw coal to deliver the material to a coal preparation plant. The paper is intended to form a basis in estimating the economics of beneficiation to meet market specifications. Situations in the Alberta Plains, Foothills and Mountain regions are assessed for surface mining costs for selected stripping ratios. The costs are presented in 1982 Canadian dollars per raw tonne as delivered to the coal preparation plant. These estimates include both ownership and operating costs. 1 fig., 4 tabs.

4125 **(IMSRP—II) Laboratory characterization of immediate floor strata associated with coal seams in Illinois.** Chugh, Y.P. (Illinois State Geological Survey, Champaign (USA)). May 1986. 118p. Illinois State Geological Survey, Champaign (USA).

This study was initiated under a research contract for the Illinois Mine Subsidence Research Program. The primary objective to generate data on engineering index properties and laboratory strength deformation characteristics of the immediate floor strata associated with coal seams in Illinois. The data are required for effective design of mine workings (mine openings and coal pillars) for optimum mine stability and resource extraction under planned and unplanned subsidence options. An additional objective was to develop a computerized data base of the available and project generated index properties and strength-deformation characteristics of immediate floor strata on a IBM-PC/XT microcomputer. 24 refs., 34 figs., 17 tabs.

4126 **(NP—9770012) IGBE yearbook 1986/87. Pay scales 1987.** (Industriegewerkschaft Bergbau und Energie, Bochum (Germany, F.R.)). 1988. 607p. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE89770012/JAW.

The volume first of all presents a survey of all the 156 wage agreements for miners concluded in 1987. For employees in the mining industry 48 agreements were concluded separately. In the addendum both the miners' and the employees' pay scales are given in full.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 4889, 4890, 4891, 4892, 4893, 4894, 4895, 4897, 4899, 4900, 4901, 4902, 4903

4127 (EMR/MB—RFC72/95-CCRL, pp 19-24) **Pipelining coal-in-oil slurries.** Brown, R.A.S. (Research Council of Alberta, Edmonton). Dec 1973. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum. (CONF-7205129—; CE—01973).

From Coal-in-oil seminar; Ottawa, Canada (17 May 1972).

Tests using two different coals from Alberta suspended in mineral oils were conducted to test the particle settling velocities and viscosity of coal-in-oil slurries. Pipeline tests in a one-inch diameter loop, and oil recovery tests using both physical and thermal separation methods, were also carried out. It was found that up to 72% coal could be added to the oil and still have a pumpable fluid. Particle attrition was observed but appeared to proceed rapidly to an equilibrium size distribution. Concentration profiles across the pipe changed from a vertical gradient due to gravity at low velocities changing to a relatively homogeneous distribution at higher Reynolds numbers; with increasing concentrations, a coring phenomenon was observed in which the solids travelled preferentially in a core leaving the annulus partially depleted in solids. Pipeline tests indicated that the slurries behaved as Newtonian fluids at coal concentrations above 50%, while viscosity tests indicated non-Newtonian behavior at coal concentrations above 10%. In summary, the tests showed that no great problems would be encountered in long-distance pipelining of coal-in-oil slurries, provided velocities and concentrations were not too low. The economics of pipelining such slurries from Alberta to Ontario is examined briefly, and delivered energy costs are estimated. 2 refs., 1 tab.

4128 **(OU/FA—7808) Techno-economic assessment of the fluidized coal preparation-transportation-dewatering process.** Debanne, J.G. (Ottawa Univ., Ontario (Canada). Faculty of Administration). Aug 1978. 107p. (CE—01971). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The expected expansion of the market for coal is expected to provide new opportunities for coal slurry pipelines as a means of coal transport. This report provides background information for designing such pipelines. Technological considerations are almost identical for other kinds of liquid pipelines, and those aspects pertaining to slurry pipelines are outlined. These include mechanical wear, internal corrosion, provision for emergency dumping, and facilities for coal preparation, dewatering, and combustion. Slurry properties can be optimized to minimize power requirements, subject to limits on the concentration of fines and on maximum grain size. A typical coal preparation plant layout is described, using as a model the installation at Black Mesa, Arizona. Energy requirements for the various parts of the process are shown. The hydraulics of coal slurry pipelines is detailed, using equations to describe such parameters as critical velocities, viscosity, and particle size degradation. Finally, an economic analysis of the costs of various components of a pipeline system is presented, in order to show how the entire process can be optimized. A method is given for calculating the comprehensive unit cost per Btu of coal, given the coal characteristics and the coal energy requirement to be transported over a given distance. 35 refs., 13 figs., 3 tabs.

4129 (SRC—TR188, pp 17-20) **The slurry pipeline system.** Husband, W.H.W. Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper outlines the general characteristics of slurry pipeline systems. A long distance slurry pipeline system consists of a number of elements: a preparation system for putting the solids into a suitable form for pipelining; the correct types and numbers of pumps for forcing the solid-liquid mixture through the pipeline at the optimum velocity; and a system for separating the slurry into its original components at the terminal end of the pipeline. The designer of such a system has to take into account a number of factors in considering the economics and design of the system, including slurry flow properties. Typical slurry pipeline systems are described, and can include pipelines transporting industrial waste or tailings, coal, ore concentrates, and limestone. 10 refs., 2 figs., 1 tab.

0140 Combustion

REFER ALSO TO CITATION(S) 4114, 4408, 4687

4130 **(DOE/FE—0108) Comprehensive report to Congress, Clean Coal Technology Program: Advanced Slagging Combustor Utility Demonstration Project: A project proposed by TRW, Inc.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Oct 1988. 56p. NTIS, PC A04/MF A01. Order Number DE89001276/JAW.

The TRW project will develop an acid rain precursor control technology for retrofit applications. One of the main objectives of this project is to demonstrate that this slagging combustor technology can result in replacement of oil with coal with no loss in unit capacity while meeting the emission requirements normally achieved when firing with oil. Another key objective is to demonstrate that TRW's slagging combustor can burn low-sulfur and commercially washed high-sulfur eastern bituminous coals and still satisfy the New Source Performance Standards (NSPS) for utility boilers and thereby provide for control of acid rain precursors. Results are discussed. 5 figs.

4131 **(DOE/MC/22078—26/2) Corrosion kinetics of selected materials for pressurized fluidized bed combustion: Final report.** Vesely, E.J. Jr. (IIT Research Inst., Chicago, IL (USA)). Dec 1987. Contract AC21-85MC22078. 124p. NTIS, PC A06/MF A01. Order Number DE88001006/JAW.

Fluidized bed combustion systems are attractive for energy production since they can burn different types of fuels. This report details work in identifying suitable materials for heat exchanger applications. Also, a first general corrosion model for deposit-enhanced pressurized fluidized bed combustion (PFBC) corrosion is described. A summary of the work performed in the program is as follows: (1) modified existing corrosion reactor to simulate deposit-enhanced PFBC corrosion environment; (2) completed test 1, a 500 h experiment to examine sample reproducibility; (3) completed test 2, a 1000 h experiment to examine the effect of deposit type and thickness; (4) completed test 3, a 4000 h experiment to examine the effect of time on the simulated deposit-enhanced PFBC corrosion on a number of different alloy chemistries; (5) completed optical examination of all the samples generated in this program and made a detailed analysis of selected samples; and (6) completed an initial hypothesis on a deposit-enhanced PFBC corrosion model, which needs further experimentation to confirm the key factors responsible for corrosion damage of metallic tubes in PFBC. 15 refs., 77 figs., 10 tabs.

4132 **(DOE/MC/23161—2632) Deposition effects in coal combustion: Annual report.** Nagarajan, R. (West Virginia Univ., Morgantown (USA). Dept. of Mechanical and Aerospace Engineering). Dec 1987. Contract FG21-86MC23161. 87p. NTIS, PC A05/MF A01. Order Number DE88010292/JAW.

We report results of a theoretical and experimental investigation of fundamental phenomena responsible for the formation of ash deposits in direct coal-fired gas turbine applications. Experimental studies were designed to simulate a gas turbine environment in terms of temperature, pressure and velocity. Sticking coefficients of residual coal ash particles impinging on a platinum target were measured as a function of target surface temperature for several coals in the Laboratory Entrained Test Reactor (LETR) and the pressurized Combustion/Deposition Entrained Reactor (CDER). The effect of metal additives (specifically, sodium) on ash deposition characteristics was also investigated experimentally. The ultimate objective of our deposition research is to develop a predictive capability for the fouling tendency of a given coal, and to identify (additive and/or coal clean-up) techniques to mitigate deposit formation. We have simultaneously developed a mechanistic model for the liquid-enhanced capture of impacting ash particles by a cooled contacting surface. The model accounts for impaction/diffusion interactions that determine the sticking fraction at low surface temperatures, and heterogeneous-reactions and particle softening phenomena that provide the requisite 'glue' liquid at higher temperature. 38 refs., 41 figs., 3 tabs.

4133 **(DOE/PC/71504—8) Operation and maintenance of DOE/PETC Combustion Test Facility: Final activity report for the period May 20, 1985--November 30, 1987.** (Gilbert/Commonwealth, Inc., Reading, PA (USA)). 1987. Contract AC22-85PC71504. 19p. NTIS, PC A03/MF A01. Order Number DE88016474/JAW.

The objective of this research and development was to expand the data base for: (1) combustion technology of coal, coal-slurry fuels and alternate fuels; (2) advanced environmental control technology to control emissions from combustion processes utilizing these fuels; and (3) other technology for utilization of coal in an environmentally acceptable manner. Results are discussed.

4134 **(DOE/PC/80752—T12) Detailed model for practical pulverized coal furnaces and gasifiers: Third annual progress report for the period May 1, 1987--April 30, 1988.** Smith, P.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 31 May 1988. Contract FG22-85PC80752. 90p. NTIS, PC A05/MF A01 - OSTI. Order Number DE88012225/JAW.

On May 1, 1985, work was initiated on a contract sponsored by a consortium of industrial and governmental agencies aimed at development of a practical, 3-D coal combustion model. The general objective of this study is to improve and extend a generalized two-dimensional, pulverized coal combustion and gasification code (PCGC-2) for application to large-scale, practical configurations, and to evaluate and implement the resulting code on an industrial scale. This report summarizes work conducted during the third year of this contract. Details of the work accomplished during each of the first two years of this project has been reported in previous annual reports (Smith and Smoot, May 1986, May 1987). The work reported in this annual summary is given by task and includes only tasks worked during this period. 57 refs., 26 figs., 6 tabs.

4135 **(EMR/MB—RFC72/95-CCRL) Coal-in-oil seminar proceedings.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Mines Branch). Dec 1973. 69p. (CONF-7205129—; CE—01973). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

From Coal-in-oil seminar; Ottawa, Canada (17 May 1972).

This seminar was part of a series of meetings held as part of a Canadian program to relate energy research to industry needs, and relates to fuel sources, fuel conservation and resource management. Presentations were made on the energy situation in Canada, the possibilities of using coal-in-oil slurries to extend Canadian oil resources, the fuel properties of coal-in-oil suspensions, pipelining coal-in-oil slurries, and practical aspects of using such slurries in power generation and industry. Separate abstracts have been prepared for five papers from this seminar.

4136 **(EPRI-CS—6009) Pilot-scale combustion characterization of two Illinois coals: Final report.** Griffith, B.F.; Lexa, G.F.; Teigen, B.C. (Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.). Nov 1988. 209p. Reseach Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002757/JAW.

The Electric Power Research Institute (EPRI) is sponsoring a comprehensive program to assess the impacts of coal quality on power plant performance. Combustion Engineering Inc. (C-E), under contract to EPRI, is investigating the combustion performance characteristics of coals of varying qualities in their combustion test facilities. Coals tested to date have included raw and cleaned coals from EPRI's Coal Quality Development Center (CQDC) in Homer City, Pennsylvania. In this study, bench and pilot-scale testing of an Illinois {number←sign}6 steam coal and a lower sulfur/lower ash Illinois metallurgical coal was done to evaluate the impacts of improving coal quality on the performance of a utility unit derated due to slagging/fouling when burning the steam coal. 20 refs., 42 figs., 34 tabs.

4137 **Heat transfer in packed-tube reactors.** Peters, P.E.; Schiffino, R.S.; Harriott, P. (Lawrence Livermore Labs., Livermore, CA (US)). *Industrial and Engineering Chemistry Research;* **27**: No. 2, 226-233(Feb 1988).

Radial heat transfer was investigated for three tubes packed with alumina spheres, cylinders, or rings. Overall heat-transfer coefficients, determined from the average gas temperature for different packed heights, were used with expressions for the effective thermal conductivity to calculate wall-film heat-transfer coefficients. The Nusselt number for the wall film increased with D/sub p//D/sub t/ as well as with the particle Reynolds number, but the effective thermal conductivity decreased with D/sub p//D/sub t/ for a given Reynolds number. These trends led to a fairly broad maximum in the curve of overall coefficient versus D/sub p//D/sub t/, with the maximum shifting to lower values of D/sub p//D/sub t/ at higher flow rates. For the same size packing, the overall coefficients for the different shapes were nearly the same over a 10-fold range of flow rates.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 4558, 4575

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 4118

02 PETROLEUM

4138 **(PITS—1988) Training planning guide 1988-1989.** (Petroleum Industry Training Service, Calgary, Alberta (Canada)). 1988. 44p. (CE—02048). Petroleum Industry Training Service, 13, 2115-27 Avenue N.E., Calgary,, Alta., Canada T2E 7E4; $N/C.

The Petroleum Industry Training Service is a nonprofit training organization, governed by the Canadian petroleum industry through a board of directors made up of senior representatives of the industry. The objectives of the organization are to identify training needs of the industry, to develop and offer training programs, to provide training advice and guidance, and to help establish standards for training which will be accepted and supported by the industry and various regulatory agencies. This document describes training courses conducted by the Service and also sets out the additional training service provided to the industry. Courses are given in oilfield production, pipeline operation, environmental management, industrial maintenance, drilling and well servicing, safety and human resources, petroleum fundamentals, and pre-employment training for floorhands on drilling rigs. Correspondence courses are also given, and there is a gas plant operations certification program. The Service also does in-house training for specific client needs. 17 figs.

0201 Reserves

4139 **(ERCB—8712) Alberta's reserves of crude oil, oil sands, gas, natural gas liquids, and sulphur.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). Dec 1987. 396p. (CE—01956). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $75.00 CAN.

This report presents tables of data on reserves of conventional crude oil, bitumen, synthetic crude oil, gas, natural gas liquids, and sulphur in Alberta. It includes estimates of initial and remaining established reserves and ultimate potential. Other information is included, such as reservoir and formation characteristics, energy content (for gas), and historical statistics on wells and additions to reserves. A folded map in pocket designates oil and gas fields, oil sand deposits, main pipelines, refineries and gas processing plants. Includes glossary.

4140 **(SAND—88-1175) Subsidence monitoring and evaluation plan for strategic petroleum reserve storage sites.** Neal, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1988. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89001059/JAW.

Subsidence is occurring at all six Strategic Petroleum Reserve (SPR) sites. It results from a combination of cavern closure, Frasch-process sulphur extraction, fluid withdrawal, and from natural causes. Of these, cavern closure resulting from slat creep is the predominant source. A subsidence monitoring program is recommended that includes: (a) continuation of annual releveling; (b) quadrennial determination of horizontal drift; (c) triennial measurement of gravity values to determine elevation change and to validate releveling data; (d) 1/2400 air photos quadrennially; (e) coordination of other subsidence monitoring efforts, especially involving regional subsidence; (f) continuation of cavern creep modeling; (g) engineering evaluation of observed and predicted subsidence effects; (h) information dissemination in the form of an annual review and report. A priority sequence is suggested that considers observed subsidence and operational factors such as oil inventories and risk appraisal. First (highest) priority is assigned to Weeks Island and West Hackberry. Second (intermediate) priority is given to Bayou Choctaw and Bryan Mound. Third, (lowest) priority is assigned to Sulphur Mines and Big Hill. The priority strategy can be used as a management tool in allocating resources and in determining relative attention that is required at the six sites. 32 refs., 1 tab.

4141 **(SEM/PG—1986) [Saskatchewan] Reservoir annual, 1986.** (Saskatchewan Dept. of Energy and Mines, Regina (Canada). Petroleum and Natural Gas Div.). [1988]. 160p. (MICROLOG—88-04329). Saskatchewan Energy and Mines, 1914 Hamilton St., Regina, Sask., Canada S4P 4V4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document is published to provide current statistical information with regard to performance and reservoir parameters of Saskatchewan oil and gas pools. This edition is subdivided into eleven sections, each dealing with a specific type of reservoir data. Maps are presented showing oil and gas pools, production and disposition areas, well spacing areas and other related information. Of considerable importance are sections which provide reservoir data and reserves for all provincial oil and gas pools broken down by unit and non-unit areas. A listing of oil and gas units provides such information as operator, producing zone, number of active wells and project data such as pattern type, commencement data and injection rates. The section titled Development Data presents information on natural depletion mechanism, enhanced recovery projects, well spacing and target areas for all Saskatchewan oil and gas pools. The remaining five sections include illustrations of typical producing well logs, pool pressure data, Maximum Permissive Rate factors, gas plant performance plots and formation water resistivity measurements. The reserve values contained in this annual are established reserves, defined as those reserves recoverable under current technology and present and anticipated economic condi-

tions, specifically proved by drilling, testing or production, plus that judgement portion of contiguous recoverable reserves that are interpreted to exist from geological, gephysical or similar information with reasonable certainty.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 5264, 5275

4142 **(BIO/AGC—939) Superficial geology of the upper Scotian Slope west of Verrill Canyon.** Piper, D.J.W.; Wilson, E.; Vilks, G.; Mudie, P.J.; Wagner, J.E. (Bedford Inst. of Oceanography, Dartmouth, Nova Scotia (Canada). Atlantic Geoscience Center). [1984]. 74p. (CE—01982). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Piston cores and high-resolution seismic-reflection profiles have been studied from an area 50 x 50 km square on the Scotian Slope, west of Verrill Canyon, in water depths of 200 to 1000 m. Apart from Verrill Canyon, no major valleys incise the slope in this area. Sand and gravel extend from the continental shelf to water depths of 400-500 m. Below this a series of shallow gullies (200-500 m wide, 5-25 m deep) lead to two large debris flows in water depths of 500-1000 m. The flows are 5-15 ms thick in seismic-reflection profiles, and there is another horizon of debris flow visible about 50 ms subbottom. Otherwise, slope sediment is acoustically well stratified and draped over topographic irregularities. Piston cores have been collected from both the debris flows and undisturbed sediment sequences between the flows. Four lithostratigraphic units are recognized in the undisturbed section. A carbon-14 date of 12,000 years before present (B.P.) has been obtained near the base of this sequence, and is consistent with the palynological and foraminiferal stratigraphies. The debris flows are overlain by a thin sediment sequence, and are estimated to date from between 5,000 and 12,000 B.P. This study provides a regional framework within which specific site surveys for hydrocarbon wells can be evaluated. 24 refs., 28 figs., 9 tabs

4143 **(NP—9770024) Status report 1988. Geotechniques and deposits.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). 1988. 869p. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE89770024/JAW.

This book contains more than 80 papers describing single projects which are financially supported by the Ministry for Science and Technology of the Federal Republic of Germany. The subjects covered are: Geophysical exploration methods; in-situ coal gasification; prospecting oil/gas and specific geological evaluations; geothermal energy projects; production techniques for petroleum and natural gas; heavy crudes - production and deposits; coal deposits and exploration; drilling techniques. All individual records are available in the database ENERGIE.

4144 (SEGJ—8801, pp 47-49) **Emprical relations of P-wave velocity and geological factors, based on logging data in oil wells.** Yamane, Kazunobu; Kitsunezaki, Choro. (Akita Univ., Mining College, Akita, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The relations between P wave velocity and rock quality, depth and age were determined on the basis of logging data in oil wells. The interval where the interval propagation travel time and rock facies were nearly uniform over 10-20m, was selected and the average velocities in those places were extracted. Emperical relation for P wave velocity was assumed as following form: Vp(m/s)=C*D/sup/x/*A/sup/y/*Fn where D:depth(m), A:age(Ma), suffix n of F means as follows: m:mudstone, i:silstone, s:sandstone, h:hardmud stone, t:tuff. This emperical equation was applied to 32 oil wells in Akita Prefecture and 26 oil wells in Niigata Prefecture to statistically determine parameters. The emperical equation indicates that the age influences slightly and P wave velocity depends on depth and rock quality. When the emperical equation was plotted for only mudstone in each oil well, higher P wave velocities were found in the raised regions where lower horizon was seen at the same depth. (5 figs, 3 refs)

4145 (SEGJ—8801, pp 35-39) **Deconvolution of uncorrelated vibroseis data.** Tada, Ryohei. (Teikoku Oil Co., Ltd., Technical Research Center, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

As part of research and development of technology for physical exploration of oil reservoir structures, a deconvolution technique is developed which serves for detailed analysis of initial motion and shaping of offset VSP profiles that represent important data processing operations required to increase the resolution of VSP data. The deconvolution technique is applied to vibroseis data before correlation (uncorrelated data) in order to modify the output wave profiles so as to meet the law of casualty. This technique makes it possible to apply deconvolution to uncorrelated data. It is also shown that the use of several convolution techniques provides minimum phase type data concerning the hypocentral wave profile, as in the case of correlated data, permitting accurate VSP initial motion reading. Thus, data in the uncorrelated state should be maintained after vibroseis work. (5 figs, 4 refs)

4146 **Effects of nonlinear reservoir compaction on casing behavior.** Chia, Y.P.; Bradley, D.A. (Argonne Natl. Lab. (US)). *SPE (Society of Petroleum Engineers) Production Engineering;* **3**: No. 3, 333-338(Aug 1988).

Depletion of overpressured, undercompacted reservoirs can cause large reservoir pressure drops and sediment compaction, which may result in casing deformation and well failure. To predict soil and casing deformation during depletion, a finite-element model was developed. Nonlinear elastic and plastic behavior of the soils and slippage along the wellbore boundary are major advancements in this study. This axisymmetric model is composed of casing wall, cement column, slippage interface, and sediments from 11,400 to 13,200 ft [3475 to 4025 m] in depth with a radius of 3,400 ft [1035 m]. This study features a process of concurrent fluid flow, nonlinear elastic and plastic soil deformation, slippage from the wellbore boundary, and casing deformation. The modeling results show that the decline in near-wellbore reservoir pressure during depletion causes vertical compaction in both the sand reservoirs and the confining shale formations. Slippage next to the wellbore decreases the axial shear load placed on the casing by the sediments. Nonlinear elastic and plastic soils show a greater tendency for casing deformation with depletion than do linear elastic soils. Axial strains in the casing above the yield strain eventually developed as near-wellbore reservoir pressure was allowed to decline to a minimum. Because this effect is quantified, the production rate may be held to a safe maximum so that the operating limits of the casing are not exceeded. Criteria are given to improve both completion design and production rate specification.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 4174

4147 **(DOE/CE/15213—T1) Aluminized low alloy steels in oil well production.** Rallis, A.T. (Allied Tool Research, Inc., Midland, TX (USA)). 1987. Contract FG01-85CE15213. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. Order Number DE88015773/JAW.

This report contains Part A and Part B on the testing of aluminized low alloy steels for corrosion resistance in oil field production equipment. Part A and Part B have been entered individually into EDB and ERA. (LTN)

4148 **(DOE/FE/61146—T1) Hydrocarbon Research Program of the University of Oklahoma Energy Center: Final report.** Mankin, C.J. (Oklahoma Geological Survey, Norman (USA)). 12 Oct 1988. Contract FG22-87FE61146. 6p. NTIS, PC A02/MF A01. Order Number DE89001569/JAW.

The objective of this research program was to develop, edit, maintain, utilize and make publicly available a computerized Natural Resources Information System (NRIS) for the State of Oklahoma. Task 13 funded the collecting and computerizing of oil and gas completion report data available for the southeastern corner of Oklahoma (the Ouachita Mountain and Arkoma Basin areas), as well as supplemental data available for a defined geographical area within southeastern Oklahoma (hereafter referred to as the Core Area) (see the map provided as Attachment 1). Coal data were also to be collected and computerized for much of this same area. Task 13 also funded the development of a computerized system for updating and maintaining oil and gas production data by lease, by field and by county for the state of Oklahoma. While the development activities for NRIS are ongoing, this report specifically addresses the progress made during the Task 13 period of November 1, 1986, through December 31, 1987. 1 fig.

4149 **Entrapment and mobilization of residual oil in bead packs.** Morrow, N.R.; Chatzis, I.; Taber, J.T. (New Mexico Petroleum Recovery Research Center (US)). *SPE (Society of Petroleum Engineers) Reservoir Engineering;* **3**: No. 3, 927-934(Aug 1988).

Phase behavior, interfacial tension (IFT), viscosity, and density data were determined for the system 2% CaCl/sub 2/ brine/ isopropyl alcohol (IPA)/isooctane. Liquid pairs from this system were used in a test of capillary number as a correlating function for mobilization of residual oil in geometrically similar porous media as provided by bead packs. Close correlation of results was obtained for a more than five-fold variation in permeability and a more than six-fold variation in IFT. Extensive investigation was also made of the change in trapped oil saturation given by vertical upward flooding; the ratio of gravity to capillary forces varied more than 100-fold. Acorrelation between trapped oil saturation and Bond number was obtained that was in good agreement with previous results obtained for gas entrapment. However, capillary numbers for entrapment of a given reduced-residual oil saturation (ROS) were found to be slightly higher than those for entrapment of gas. Relative permeabilities were independent of whether the trapped phase was oil or gas and were determined mainly by the magnitude of the trapped nonwetting-phase saturation. Capillary numbers for mobilization of residual oil from bead packs were much higher than typical values for sandstones. For bead packs that had been consolidated by sintering, capillary numbers for prevention of entrapment increased and those for mobilization decreased. The net results was that differences in capillary numbers for mobilization and entrapment were greatly reduced and results became more akin to relationships observed for consolidated sandstones.

4150 **Size-exclusion chromatography in the measurements of concentration and molecular weight of some EOR polymers.** Hunt, J.A.; Young, T.S.; Green, D.W.; Willhite, G.P. (Univ. of Kansas (US)). *SPE (Society of Petroleum Engineers) Reservoir Engineering;* **3**: No. 3, 835-841(Aug 1988).

Procedures that involve the use of size exclusion chromatography (SEC) for the measurement of concentration and weight-averaged molecular weight, M-bar/sub w/, of some EOR polymers were developed and found to give improved detectability, accuracy, and/or efficiency. The separation of polymer from low-molecular-weight impurities by size allows unambiguous detection of polymer properties such as concentration and M-bar/sub w/. A combination of an SEC column of a pore size small enough to exclude the polymer totally and a mobile phase of ionic strength of 1.5 was found suitable for the separation of polyacrylamide, partially hydrolyzed polyacrylamide, cationic polyacrylamide derivative, and xanthan polysaccharide from impurities. Concentration detection of the separated polymer sample with a variable-wavelength ultraviolet (UV) detector was found to give superior detectability over detection by refractive index difference. A wavelength of 214 nm [2,140 A] was used for the detection of these polymers on the basis of the spectra of samples purified by dialysis. With the active polymer assay determined by reprecipitation into a nonsolvent, the detection limit by UV was determined to be <0.1 μg/cm/sup 3/ for polyacrylamide and a cationic polyacrylamide derivative, <0.2 μg/cm/sup 3/ for partially hydrolyzed polyacrylamide, and <0.7 μg/cm/sup 3/ for a xanthan polysaccharide. The linear calibration range was up to 500 μg/cm/sup 3/. The precision of the concentration measurement was better than 4% for polyacrylamide and its derivative and 5% for polysaccharide at a 95% confidence level.

0204 Processing

REFER ALSO TO CITATION(S) 4090

4151 (KFK-PEF—35-Vol.2, pp 729-738) **Desulfurization of liquid petroleum and petroleum fractions by oxidation with excited oxygen.** Suhr, H.; Becker, E.; Kopetschke, B.; Nauenburg, K.; Iacocca, D.; Ropero, M.; Ramirez, J.; Sanchez, N.; Uslar, J. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Organische Chemie; Universidad Central de Venezuela, Caracas. Escuela de Quimica). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

A process is being developed to desulfurize high boiling petroleum fraction and residue oils by contact with an oxygen plasma. The sulfur compounds are oxidized and form a separate phase. The metohd has been tested with representative sulfur compounds, with simple mixtures and with petroleum fractions. The present report besides briefly reviewing previous results describes investigations of the last year and summarizes the status at project termination.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 4141, 4154, 4555, 4558, 4575, 4586

4152 (CANWEC—1988, pp 94-98) **Exploration and market potential for oil from eastern Canada.** Stanford, J.M. (Petro-Canada Resources). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

The development of offshore oil resources from Atlantic Canada is outlined. This development has followed cycles of exploration, discovery, and relative inactivity, depending on technological limits and oil prices. Projected declines in Canadian and US oil production mean that a market for such offshore oil will be present; however, at current oil price levels, some kind of large-scale financial incentive is felt to be necessary. 1 fig.

0208 Waste Management

REFER ALSO TO CITATION(S) 4143

0209 Environmental Aspects

4153 **(PNL-SA—16262) A review of intermediate-scale experiments for subsurface microbiology and chemistry: Summary report.** Streile, G.P.; Fredrickson, J.K.; Zachara, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1988. Contract AC06-76RL01830. 47p. (CONF-8704329—1). NTIS, PC A03/MF A01. Order Number DE89001750/JAW.

From OHER/DOE workshop; Lewes, DE, USA (12 Apr 1987).

This report contains the synopsis of a workshop that was sponsored by DOE/OHER and the Pacific Northwest Laboratory (PNL) to review the experimental facilities in SERF. Because the intermediate-scale facilities represent the most important component of SERF, this review was held by DOE during the conceptualization stage of these facilities to ensure that the most up to date disciplinary and interdisciplinary scientific concepts, questions, and issues had been considered in their design. The workshop contained nationally recognized scientists with expertise in hydrology, geochemistry, or microbiology. By reviewing a "strawman facility

design and experimental sequence" the participants provided constructive guidance that greatly improved the conceptualization of the intermediate-scale research component of SERF. 3 refs.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 4156, 4159

4154 (EPS—87-24) Leaded and Lead-free Gasoline Regulations Monitoring Program. Poon, D. (Environnement Canada, Ottawa, Ontario. Conservation et Protection). 1987. 32p. (MICROLOG—88-04815). Environment Canada, Publications Section, Terrasses de la Chaudiere, Ottawa, Ont., Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Pacific and Yukon regional office of Environmental Protection, Environment Canada monitors the lead levels in leaded and lead-free gasoline sold in British Columbia to ensure compliance with the federal Leaded Gasoline and Lead-Free Gasoline Regulations under the Clean Air Act. The monitoring results indicate a continuing trend towards improved compliance with respect to the rates of lead-free gasoline contamination, nozzle switching on dispensing pumps and vehicle misfueling. While the leaded gasoline sampled fom the production plants complied with the new standard of 0.29 g/l, which became effective January 1, 1987, the samples collected from retail outlets were not in 100% compliance. 17 out of 58 of these samples contained lead in excess of 0.29 g/l, with one sample containing more than 0.44 g/l. These results indicate that earlier production gasoline with higher lead content remained in the marketing system at the time of sampling. Nozzles of leaded gasoline pumps were also checked, and 20 out of 620 nozzles were undersized. The nozzle switching rate was therefore 3.2%. In a survey of misfueling practices at 7 Vancouver area retail outlets, a total of 498 vehicle refuelings were observed. Eight motorists refueled with leaded gasoline to their cars that were designed for lead-free gasoline. Consequently, 3-4% of the lead-free burning cars were misfueled. This rate indicates a reduction from 13% in 1985 and 5-7% in 1986. 1 fig., 9 tabs.

4155 (ERCB—D88-15) Westhill Resources Limited application for well licenses, Acheson East field. Interim decision D88-15. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 2p. (CE—02014). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

A public hearing was held to consider application for well licensing in an industrial area in the city of Edmonton, Alberta. Interventions were made expressing concern over the wells' appearance and the possible odors from hydrogen sulfide release. At the hearing, the applicant requested an early decision so that it could take advantage of a government incentive. Having heard the evidence presented, it was concluded that the applications can be approved subject to the undertakings given at the hearing, and this interim decision was issued so that the applicant would not be unduly penalized because of the length of time required for preparing a formal decision report.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 4127, 4146

4156 (ERCB/C—D88-13) Pipeline application to construct crude oil pipelines in the Red Earth and Kidney areas. Decision D88-13. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 8p. (CE—02004). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Applications were submitted by Unocal Canada, Gulf Canada Resources, and Murphy Oil for permission to construct pipelines and related facilities in the Wabasca River area of Alberta. In essence, the applications of Unocal and Murphy are a scheme for the transport of their own oil, and that committed to them, through their own pipeline systems to the Peace Pipe Line and on to Edmonton; whereas the applications of Gulf are a scheme for transporting the same oil through the existing Wabasca River Pipeline to the Rainbow Pipe Line and on to Edmonton. The technical qualification and environmental impacts of the pipelines were already considered to be satisfactory, and the issues of the applications were confined to the need for the pipelines, the economics of the pipelines, and pipeline proliferation. A hearing was held to consider these issues. It was found that although economics favor the Unocal/Murphy proposed pipelines, that could be changed by negotiation in a competitive business environment. Given the technical/environmental acceptability of the pipeline proposals, there was no reason to interfere with normal business transactions. The granting of the Murphy and Unocal applications was not felt to impinge on the right or opportunity of Gulf to pursue its pipeline project. All four applications were granted. 1 fig., 2 tabs.

4157 (NP—9770019-Pt.1) SOLS Subsea Oil Loading System for tankers. Phase 3. Pt. 1. Michaelsen, B.; Eichner, C.R.; Sterzenbach, M. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Hamburg (Germany, F.R.); Deminex-Deutsche Erdoelversorgungsgesellschaft m.b.H., Essen (Germany, F.R.); Thyssen Nordseewerke G.m.b.H., Emden (Germany, F.R.)). Sep 1987. 189p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770019/JAW.

Following development of the SOLS (Subsea Oil Loading System) in a feasibility study and a 2nd phase, with successful simulations and manoeuvring in shallow water with the 1:1 prototype of the main components, Phase III comprised building and deepwater testing of all main system components - the re-entry unit, the hose and the winch with the control facilities. Extensive tests were carried out on a barge in a Norwegian fjord and also supplemented by safety analyses, pressure tests, simulations of system behaviour under seastate conditions and intensive separate tests of all components. The result is a tested system that is suitable for application under North Sea conditions.

4158 (NP—9770020-Pt.2) SOLS Subsea Oil Loading System for tankers. Phase 3. Pt. 2. Michaelsen, B.; Eichner, C.R.; Sterzenbach, M. (Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Hamburg (Germany, F.R.); Deminex-Deutsche Erdoelversorgungsgesellschaft m.b.H., Essen (Germany, F.R.); Thyssen Nordseewerke G.m.b.H., Emden (Germany, F.R.)). Sep 1987. 197p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770020/JAW.

Following development of the SOLS (Subsea Oil Loading System) in a feasibility study and a 2nd phase, with successful simulations and maneuvering in shallow water with the 1:1 prototype of the main components, Phase III comprised building and deepwater testing of all main system components - the re-entry unit, the hose and the winch with the control facilities. Extensive tests were carried out on a barge in a Norwegian fjord, and also supplemented by safety analyses, pressure tests, simulations of system behaviour under seastate conditions and intensive separate tests of all components. The result is a tested system that is suitable for application under North Sea conditions.

4159 (NEB-SS—NE22-1/199-5E) Reasons for decision in the matter of an application under parts 3 and 4 of the National Energy Board Act by Trans Mountain Pipe Line Company Ltd. Hearing Order OH-1-87, as amended July 1988. (National Energy Board, Ottawa, Ontario (Canada)). Jul 1988. 56p. (CE—01978). National Energy Board, Regulatory Support Office, 473 Albert Street, Ottawa, Ont., Canada K1A 0E5; $N/C.

Trans Mountain Pipe Line Company applied to Canada's National Energy Board for a two-stage expansion of its facilities and for a number of modifications to its existing toll design. Hearings were held and included examination of evidence relating to environmental and socio-economic concerns. The proposed Stage 1 expansion includes additions to 7 pump stations and the construciton of 2 new pump stations and 5 new storage tanks. The Board was satisfied that this proposed expansion is in the public interest, and authorized construction of the facilities. The proposed Stage 2 facilities include the construction of 3 new pump stations and the

recommissioning of 2 existing loops; this stage was designed to accommodate additional throughputs of MTBE and methanol, heavy crude, or a combination thereof. The Board did not authorize construction of Stage 2 expansion. The Board approved the applicant's proposal to roll the capital and operating costs of the Stage 1 facilities into a common rate base and revenue requirement. A means for estimating capacity surcharges and credits was determined, and surcharge and credit rates were established by the Board. The Board directed implementation of a 15% fuel and power surcharge and also directed an approach to estimate the level of fuel and power credits. Refined products special charges were eliminated for certain receiving, delivery, and transport facilities. Certain costs related to Shell-owned facilities were allocated, and the applicant was directed to develop a methodology for determining tankage credits. 1 fig., 5 tabs.

0230 Properties

REFER ALSO TO CITATION(S) 4175

0240 Storage

REFER ALSO TO CITATION(S) 4140

0250 Combustion

REFER ALSO TO CITATION(S) 4135, 4173, 4685, 4692

4160 **(DGMK—287-03) Nickel emission measurements from heavy oil-fired furnaces.** Rieskamp, H. (Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.); Technischer Ueberwachungs-Verein Hannover e.V. (Germany, F.R.)). Nov 1987. 151p. (In German). Deutsche Wissenschaftliche Gesellschaft fuer Erdoel, Erdgas und Kohle e.V., Hamburg (Germany, F.R.).

In the frame of a series of tests on the national level 20 heavy oil-fired boilers were tested for their specific nickel emissions. While the nickel concentrations of the heating oils analyzed were ranging between 9.4 and 46.5 mg/kg, the total exhaust gas dust content was found to be between 25.5 and 1890 mg/m/sup 3/, total exhaust gas nickel concentrations between 0.30 and 3.65 mg/m/sup 3/, and water insoluble exhaust gas nickel concentrations between 0.06 andd 2.86 mg/m/sup 3/. The following values were assessed in the case of boiler systems the exhaust gas dust concentrations of which compiled with the requirements of 1986 air pollution regulations: total exhaust gas dust concentration: 25.5 to 49.1 mg/m/sup 3/; total exhaust gas nickel concentration: 0.30 to 1.41 mg/m/sup 3/; water-insoluble exhaust gas nickel concentration: 0.06 to 0.84 mg/m/sup 3/; heating oil nickel concentration: 9.4 to 38.6 mg/m/sup 3/. (orig.) With 19 figs., 104 tabs., 15 refs.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 4139, 4141

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 4143, 5264, 5275

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 4143, 4148, 4163, 4165, 4166

4161 **(ACERR—1979) Alberta helium technical report, April 1 - September 30, 1979.** (Alberta/Canada Energy Resources Research Fund, Edmonton). 1 Apr 1979. 11p. (CE—01979). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A process has been developed in Alberta to separate helium from natural gas in an energy efficient manner, using reverse osmosis through a series of fiber membranes. A pilot plant program has also been set up and some of the plant test results are presented. Different membrane configurations were tried in order to optimize the process. Data are given on membrane permeability to helium, and the feed, residue, and permeate concentrations in the 3 stages of the process. The helium enrichment in each stage is quite close to the predicted value based on pure gas permeabilities as measured in the laboratory. Operation of the pilot plant has revealed no control or stability problems, and length of operation is currently limited only by the service life of the spring in the discharge valve assembly of the first stage. The work has demonstrated the technical feasibility of recovering helium from natural gas under field conditions. 2 figs., 3 tabs.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 4141, 4167, 4168, 4558, 4575, 4586

4162 (CANWEC—1988, pp 101-109) **Markets and prices in the United States for natural gas from eastern Canada.** Jensen, J.T. (Jensen Associates Ltd., Boston). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

The combination of deregulation in the purchase and transportation of natural gas, and the fall in gas prices, has brought about massive structural changes in the natural gas industry in the USA. Gas markets have become national rather than regional, and the decline in the market has been regionally and sectorially uneven. This new situation has serious implications for the Canadian gas industry, not only because of decreased exports to the USA. The gas recently discovered off Canada's Atlantic coast, when commercially developed, will likely be linked to the North American pipeline grid for delivery to northeastern USA markets. However, although this appears to be in the classic mode of expansion whereby a new gas source is connected to a nearby market, the new market situation means that this new gas cannot escape the new national patterns of competition. In this context, prices are of prime interest; in the deregulated pricing environment in the USA, prices in the northeast could be expected to reflect market pricing for cheap southwestern gas (plus transport costs). Other factors affecting the market are the price of gas relative to oil, the short-run demand as affected by the large body of dual-fuel boiler load found in the USA, and gas price competition at the wellhead. Implications of these market trends for eastern Canadian gas supply are complex, but the gradual disappearance of the gas surplus in the USA should raise the value which Canadian supply can expect to see in northeast markets. 5 figs.

0308 Environmental Aspects

4163 **(ERCB—88-AA) Sulphur recovery guidelines for sour gas plants in Alberta.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 14p. (CE—02027). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

This report presents the decision of Alberta Environment (AE) and the Energy Resources Conservation Board (ERCB) on sulfur recovery guidelines for sour gas plants in Alberta. The report also includes a summary of the review process and the recommendations and views of the participants. AE and ERCB agree that generally, the sour gas industry operates well within Alberta's stringent standards for ambient air sulfur dioxide concentrations, and that there is no evidence to date that demonstrates that sulfur emissions from that industry have had a deleterioius effect on local health or environment. However, in the view that the long term objective must be to limit atmospheric loading of pollutants to the extent that is practical, AE and ERCB have concluded that some upward adjustment to the requirements would be in the public interest, particularly where the technlogy appears to be available and

the cost is not prohibitive. Effective immediately, new plants sized at 2,000 tonnes/d or larger will be subject to sulfur recovery requirements which have increased from 99 to 99.8%, with lower requirements for plants of lower sizes. It is important to note that for individual plants, AE and ERCB would consider requiring sulfur recovery levels higher than set out in the guidelines if a site-specific need were shown to exist. In addition, it is believed that some degree of sulfur recovery should be required for plants in the 1 to 10 tonne/d range, at which sulfur recovery is not now required. The new requirements apply to all new plants, to existing plants with substantial capacity expansion or process modification, or in cases where substantial new sour gas volumes, not in the original plant approval, have occurred. 3 figs.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 4163, 4169

4164 **(DOE/IG—0259) The Federal Energy Regulatory Commission's (FERC) wellhead pricing refund program.** (USDOE Office of Inspector General, Washington, DC). 29 Sep 1988. 8p. H. Order Number TI89001834/JAW.

Reviewed here is the Federal Energy Regulatory Commission's (FERC) program for carrying out wellhead pricing refund requirements under the Natural Gas Policy Act of 1978 (Gas Policy Act). This review was initiated in response to an audit request by FERC. The purpose of our review was to determine whether natural gas producers refunded overcharges to purchasers and reported refunds to FERC in a timely manner.

4165 **(ERCB—A861041) Campbell-Namao gas processing plant. Memorandum of decision.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 1988. 2p. (CE—02015). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

A submission was received to amend an earlier gas processing plant application. This amendment would provide for installation of facilities for complete removal and recovery of sulfur compounds in the raw gases to be processed in the plant, located in a prime agricultural area of Alberta. A pre-hearing meeting was convened regarding the potential acceptability of the amended plant, and the possible need for reopening the hearing process. Local residents, although recognizing that the sulfur emissions question had now been substantially addressed, still perceived other concerns. It was decided that the hearing should be reopened to consider the amended facilities and the new concerns.

4166 **(ERCB/C—D88-9) Cherron Canada Resources Ltd., ICG Resources Ltd., Gas Processing Facilities in the Acheson Field. Decision D 88-9.** (Energy Resources Conservation Board, Calgary, Alberta (Canada)). 7 Jul 1988. 13p. (CE—02039). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $5.00 CAN.

Two applications were received regarding natural gas processing facilities in Alberta. Chevron Canada applied for approval to construct a sour gas plant, with waste gases to be injected into underground formations. ICG Resources applied for approval to increase the capacity of its Acheson sour gas plant, proposing that a Lo-Cat sulfur recovery process be used to recover sulfur from the raw gas. Under normal operating conditions, no sulfur would be released to the atmosphere from either plant. A hearing was held to consider these applications; differences between Chevron and ICG were resolved by an agreement whereby Chevron would purchase and salvage the ICG plant, therefore the ICG application was withdrawn. The issues considered in Chevron's applications were considered to be: the need for additional processing capacity in the Acheson area, and sulfur recovery or acid gas disposal. It was agreed that additional capacity was required for Chevron's gas processing needs, for processing fluids from Chevron's miscible flood operations, and to accommodate the processing needs of third-party producers in the area. It was decided that the additional facilities are justified and should be operated by Chevron at the same site as its existing miscible flood and oil battery facilities. These facilities should incorporate means to ensure that there are no sulfur emissions under normal operating conditions.

4167 **(NEB-SS—NE22-1/1988-7F) Reasons for decision in the matter of Canadian Hunter Exploration Ltd. Applicant pursuant to part VI of the National Energy Board Act for a licence to export natural gas.** (National Energy Board, Ottawa, Ontario (Canada)). Aug 1988. 10p. (In French). (CE—02041). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, Ont., Canada K1A 0E5; $N/C.

An application was made before the National Energy Board of Canada for approval of a license to export natural gas through Ontario to the USA. The customer in the USA will use the gas to fuel a new cogeneration facility to be constructed in Syracuse, NY which will produce electricity to be sold to a utility and steam to be sold to various institutional customers in the surrounding area. An export impact assessment was performed, and indicated that the proposed annual export volumes were small compared to Canada's supply and requirements, and should have little impact on Canadian production, consumption and prices of natural gas. The Board also examined the contracts executed by the applicant and various customers in the USA. A unique aspect of the gas sales agreement is an up-front payment of $70 million (US), a pricing provision intended to provide a measure of cost certainty to the institutions financing the project. Another feature of the agreement is that it allows for interruptible transportation in both the USA and Canada in the event that firm transportation is not available. The Board also examined the gas supply available to the applicant and was satisfied that adequate gas supplies will become available to meet the requirements of the gas sales agreement. In addition, the applicant's cost-benefit analysis of the proposed gas export sale is discussed. A license was issued to export at total of 3,381 million m/sup 3/ of gas from 1990 to 2010.

4168 **(NEB-SS—NE22-1/1988-6E) National Energy Board, reasons for decision. TransCanada PipeLines Ltd. Applications for facilities and approval of toll methodology and related tariff matters.** (National Energy Board, Ottawa, Ontario (Canada)). 1987. 160p. (CE—02042). National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, Ont., Canada K1A 0E5; $N/C.

An application was made to permit new facilities to expand the capacity of the TransCanada pipeline system in order to serve existing markets and to deliver additional export volumes to the northeast USA. Total cost of these proposed facilities was estimated at $334 million. Gas to be delivered at Niagara Falls and Iroquois, in Ontario, would be transported through proposed new pipelines in the USA. TransCanada also requested that the presently used methods of cost allocation and toll design for export sales and transmission services be continued and applied to the proposed facilities. In addition, application was made for addiitonal pipeline and related construction on the Montreal Line, as a result of requests for additional service. A public hearing was held to consider these matters. The forecasted export requirements were found to be reasonable for the purpose of assessing facilities requirements for 1988 to 1990. An expansion of the TransCanada system was felt to be required. The proposed facilities were approved, except those relating to exports through Iroquois, because it was not found that the pipelines on the USA side of that export point would be completed in time to achieve a November 1, 1989 service date. TransCanada's toll methodology was also approved, and a method for calculating incremented costs was developed. A number of other matters relating to tariffs were decided, including facilities for short term firm service, provisions for renewals of long term firm service contracts, queuing of applicants for transportation capacity, and open access. 4 figs., 10 tabs.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 4167, 4168

4169 **(NTPUB—1988) Natural gas distribution in the Hay River and Pine Point, Northwest Territories.** (Northwest Territories Public Utilities Board, Yellowknife (Canada)). [1988]. 64p. (MICROLOG—88-04388). Public Utilities Board of the NWT, P.O. Box 697, Yellowknife, N.W.T., Canada X1A 2N5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Two applications for the right to distribute natural gas in certain towns in the Northwest Territories were made to the territorial Public Utilities Board. Each applicant carried out a market study, and the results of the two studies were similar. Capital cost projections made by the applicants were also similar, in the upper 5 million dollar range. There was seen to be little difference in the standards of construction, operation of the utility and provision of service, as proposed by the two applicants. Consultants were used to make recommendations on which applicant should undertake the project. Issues considered in evaluating the applicants were selected to be: the ability of the company to arrange for an adequate gas supply; the ability to carry the project through to completion; the criteria for the proposed gas rates; the standards of construction and past experience; and the level of customer service proposed to be provided. Northland Utilities was considered to be the strongest applicant. 7 tabs.

0340 Combustion

4170 (IES—8801, pp 51-52) **Spontaneous combustion properties of combustible gas.** Ogawa, Terushige; Seki, Takashi; Itagaki, Haruhiko. (Yokohama National Univ., Faculty of Engineering, Yokohama, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

In order to prevent ignition and explosion accidents of combustible gas and vapor, it is important to assess properly its danger. For assessing the above danger, various parameters such as ignition temperature and explosion limit, etc. are used. These parameters can be obtaind normally by testing. Accordingly, in this report, in order to obtain the basic data for assessing the scale effect and the effect of the shape of the closed space against the explosion danger in the closed space, the effects of the size and length of the explosion space on the spontaneous combustion properties and the flame propagation properties of combustible gas were investigated by using methane-air mixed gas. Furthermore, the applicability of the thermal ignition theory and the relatively simple flame propagation theory to the above assessment was studied. As the results, it was found, inter alia, that the application as is of the data obtained in laboratory to the actual operation was dangerous and the prediction of the danger in the actual operation by combining the actually measured data with theoretical formula such as the thermal ignition theory was necessary. (5 figs)

04 OIL SHALES AND TAR SANDS

4171 **(AOSTRA—87) Alberta Oil Sands Technology and Research Authority, ten year review.** (Alberta Oil Sands Technology and Research Authority, Edmonton (Canada)). 1987. 64p. (CE—02001). Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, Alta., Canada T5J 3L8; $N/C.

The Alberta Oil Sands Technology and Research Authority (AOSTRA) was established in 1974 with a mandate to develop the technology to realize the potential of Alberta's heavy oil and oil sands deposits. This ten year review shows the considerable progress that has been made in achieving the objectives of this mandate. In the Athabasca Deposit, commercial production is under way, and related research is being conducted into such matters as the oleophilic sieve process, whole-sand retorting in the Taciuk Processor, and recovery using steam drive, electrical heating, and horizontal wells. In-situ techniques are being examined for recovery of bitumens in the Devonian carbonates underlying the oil sands. In the Peace River Deposit, a pilot plant is investigating in-situ steam recovery processes and the plant is being expanded to semicommercial operation. In the Cold Lake Deposit, commercial production is going on along with research into improved recovery techniques. Other AOSTRA projects include improved techniques for enhanced recovery for conventional oil, water treatment processes for steam-based recovery, improved upgrading of bitumen, bitumen chemistry, geology and geotechnical aspects of oil sands deposits, and environmental effects research. Special AOSTRA programs include technology transfer, international cooperation, inventors' assistance, and information retrieval. 80 figs., 2 tabs.

4172 **(AOSTRA—8703) 12th Annual report of the Alberta Oil Sands Technology and Research Authority for March 31, 1987.** (Alberta Oil Sands Technology and Research Authority, Edmonton (Canada)). Mar 1987. 54p. (CE—02000). Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, Alta., Canada T5J 3L8; $N/C.

The Alberta Oil Sands Technology and Research Authority (AOSTRA) is a provincial crown corporation whose mandate is to promote research and development into the technological methods required for the efficient and economic recovery and processing of oil sands products from the oil sands deposits, and the effective and economic recovery of crude oil through the use of enhanced recovery methods. AOSTRA also promotes research into the methods required to ensure acceptable environmental quality after such recovery and processing operations, and promotes and implements solutions to technological problems impeding the development of production capacity to meet the demand of crude oil, synthetic crude oil, and products derived from crude oil. AOSTRA's involvement in technology development ranges from fundamental, academic, and institutional research to the support of large-scale field pilots and demonstration units in cooperation with industry (foreign and national) and various federal and provincial government bodies. This report reviews AOSTRA's activities for the year, including programs in oil recovery, mining, upgrading, produced water recycling, technology transfer, and cooperative research. A list of AOSTRA-assigned patents is included, as well as financial statements.

4173 (EMR/MB—RFC72/95-CCRL, pp 7-17) **Potential conservation of oil resources by the coal-in-oil concept.** Convey, J. Dec 1973. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum. (CONF-7205129—; CE—01973).

From Coal-in-oil seminar; Ottawa, Canada (17 May 1972).

This paper discusses coal-in-oil slurries as an energy source and evaluates its feasibility for extending Canadian oil resources. Details are presented on the fuel properties of such slurries, potential supplies and reserves, and potential consumption. It is estimated that adding 1.1 billion tons of coal to present proven oil reserves will extend oil resources by 7 years at 1970 rates of consumption. Adding the total recoverable 4.5 billion tons of high-rank western coal to the oil that is assumed to be recoverable will extend the oil resources by 30 years. Also discussed are a number of strategies to conserve oil resources, some offering improved efficiency, with which the coal-in-oil concept must compete. These include use of the combined gas turbine/steam cycle in thermal power generation, coal gasification, coal liquefaction, fluidized-bed coal combustion, improved combustion processes, and magnetohydrodynamic power. 1 ref., 5 tabs.

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 4139, 4146

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 4098, 4099

4174 **(EMR—1985) Fuel options for enhanced hydrocarbon recovery.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Nov 1985. 283p. (MICROLOG—88-04576). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

The object of this report is to examine the capital and operating costs associated with alternative steam raising fuels for enhanced recovery of oil sands and heavy oil, in order to assess the current economics at anticipated scales of operation and at different producing locations within Alberta. Total energy requirements for enhanced recovery projects are estimated according to fuel (natural gas, coal, coke), showing that significant fractions of present production will be needed to satisfy these requirements. In order to determine the most economical fuel used at each of the major heavy oil/oil sand areas, the technical acceptability and the delivered fuel cost were examined; in order to maximize each fuel's cost effectiveness, a number of logical sources for each fuel are selected. Fuel transportation costs are estimated for methods including pipeline, road, and rail transport. An examination is made of the burning technologies that are considered practical for each fuel, along with the associated steam generation equipment. In comparing the economics of the various in-situ steam projects, this study focuses exclusively on the difference made to the project economics by the use of a fuel other than natural gas, and uses a conservative, cost-of-service approach. It is found that at each demand site, there is some minimum volume of fuel demand at which coal or petroleum coke can provide equal or better economics than natural gas. The break-even volumes of production needed to achieve this minimum fuel demand volume are well below planned levels at each producing region. Sensitivity analyses indicate the economics are very sensitive to gas prices and capital costs. 75 refs., 74 figs., 75 tabs.

0405 Properties And Composition

4175 **(EMR/ER—86-78TR) Size exclusion chromatography for characterization of heavy oil/bitumen vacuum bottoms as feedstocks for coprocessing.** Rahimi, P.M.; Kelly, J.F. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). Apr 1986. 27p. (MICROLOG—88-04568). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Cold Lake vacuum bottoms, a potential feedstock for coprocessing, has been separated according to molecular weight on Styragel 100 A using preparative gel permeation chromatography (GPC). The average molecular weight (determined by vapour pressure osomometer) of 10 arbitrary fractions obtained by this fractionation technique ranged from 228 to 2074. Using an analytical GPC equipped with Shodex columns (divinyl benzene polymer) a linear relationship was found between the logarithm of the molecular weight of fractions and retention volumes. Elemental analysis of the fractions showed an increase in nitrogen and sulphur contents as a function of molecular weight. H/C atomic ratios increased with decreased molecular weight and peaked at 648 g/mole. Conversely, aromaticity decreased sharply to a minimum at 548 g/mole and then increased gradually as molecular weight increased. 27 refs., 10 figs., 3 tabs.

0406 Direct Uses And By-products

4176 **(EMR/ER—87-87TR) Bubbling fluidized bed combustion of Syncrude coke.** Anthony, E.J.; Becker, H.A.; Code, R.R; McCleave, R.W.; Stephenson, J.R. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). Nov 1987. 46p. (MICROLOG—88-04569). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Trials on the burning of Syncrude coke (solid residue of Athabasca oil sands after processing), were performed in an atmospheric fluidized bed combustion (AFBC) pilot plant (bed area 0.155 m/sup 2/). The coke is high in sulphur, up to 7% by mass, and reduction of S0/sub 2/ emissions is therefore necessary. An Athabasca limestone was used as the S0/sub 2/ sorbent. The conditions of the trials were mean coke particle diam. 0.26 mm; mean limestone particle diam. 0.34-0.94 mm; fluidizing velocity 0.8-1.3 m/s; exess air, up to 7%; recycle ratio (fraction of cyclone catch recycled) 0-0.83; Ca/S mole ration 1.7-2.9, bed temperature 966-1105/sup 0/C. The high bed temperatures were needed to achieve stable burning and reasonable combustion efficiency. The combustion efficiency as measured by carbon burnup was 77-97%. At these temperature levels, sulphur capture was influenced most strongly by bed temperature. The capture was unexpectedly good up to 1050/sup 0/C then fell sharply, practically to zero above 1100/sup 0/C. It is concluded that Syncrude coke can be burned by AFBC with acceptable combustion efficiency and sulphur capture at bed temperatures of 950-1050/sup 0/C and fluidizing velocities up to 1.3 m/s. Syncrude coke is high in vanadium, 0.18% by mass, as well as in sulphur. The results indicate that the vanadium is fixed in the ash and is not selectively concentrated in any of the product streams. 13 refs., 22 figs., 4 tabs.

0409 Waste Research And Management

4177 **(EMR/ER—88-02TR) Preliminary investigation of the microfiltration of oil sands tailings pond sludge.** Farnard, B.; Sawatzky, H. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Energy Research Labs.). Oct 1987. 17p. (MICROLOG—88-04570). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. $0.34 CAN per page, $3.40 minimum; MF $10 CAN.

Oil sands tailings pond sludge was processed by membrane microfiltration to assess a process for dewatering sludge. Raw and deoiled sludges from the Syncrude tailings ponds were prepared by using a laboratory bench-scale model of a proposed commercial process. Encouraging results were obtained with the raw sludge in static microfiltration although the bitumen adhered to the polymeric parts of the progressing cavity pump in the cross flow system. The deoiled sludge did not have the same problem, and cross flow microfiltration results were obtained. The permeate was free of oil and visible solids and had very low turbidity. The permeation rates were between 0.5 to 2.0 m/sup 3//m/sup 2//d at less than 100 kilopascals operating pressure. There was a substantial reduction of the permeation rate that was caused by selectively removing water and leaving concentrated slurry at the membrane surface (gel limited permeation) and the optimal pressure may have been as low as 50 kilopascals. These results demonstrate the technical feasibility of microfiltration and provide a basis for its economic assessment. 5 refs., 4 figs., 3 tabs.

05 NUCLEAR FUELS

0505 Uranium Enrichment

REFER ALSO TO CITATION(S) 4236

4178 **(K/ITP—156/P1/R1) Nuclear material safeguards for enrichment plants: Part 1, Uranium enrichment: General principles and processes: Safeguards training course.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1988. Contract AC05-84OT21400. 262p. (ISPO—284/P1/R1; CONF-881199—Pt.1-Vugraphs). NTIS, PC A11/MF A01 - OSTI. Order Number TI89001601/JAW.

From Safeguards training course: nuclear material safeguards for enrichment plants; Vienna, Austria (14 Nov 1988).

This 5-day training course on nuclear material safeguards for uranium enrichment plants has been developed for the International Atomic Energy Agency (IAEA) by Martin Marietta Energy Systems, Inc., under the US Program for Technical Assistance to IAEA Safeguards. The purpose of the course is to train IAEA professionals who are responsible for safeguarding uranium enrichment facilities on the safeguards relevant principles of enrichment technology, particularly as related to centrifuge enrichment plants. 7 refs.

4179 **(K/ITP—156/P3/R1) Nuclear material safeguards for enrichment plants: Part 3, Gas Centrifuge Enrichment Plant: Description, material control and accountability procedures, and IAEA safeguards: Safeguards training course.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1988. Contract AC05-84OR21400. 349p. (ISPO—284/P3/R1; CONF-881199—Pt.3-Vugraphs). NTIS, PC A14/MF A01. Order Number DE89002148/JAW.

From Safeguards training course: nuclear material safeguards for enrichment plants; Vienna, Austria (14 Nov 1988).

This part of the training course contains: Demonstration of the enrichment verification measurement technique for cascade header pipes; Centrifuge enrichment plant description; IAEA safeguards at a gas centrifuge enrichment plant; and Centrifuge facility material control and accountability procedures.

4180 **(LA—11277-MS) Accurate, wide-range uranium enrichment measurements by gamma-ray spectroscopy: 1, Characterization of enrichment standards; 2, Demonstration of enrichment measurement capability.** Parker, J.L.; Brooks, M. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 67p. NTIS, PC A04/MF A01. Order Number DE89002110/JAW.

Section 1 describes the repackaging and recharacterization of 19 approximately 1-kg lots of uranium oxides, with enrichments (^{235}U at. %) ranging from 0.7 to 91 at. %, for use primarily as working standards in gamma-ray enrichment measurements. The results of all characterization analyses are given. Section 2 describes demonstration gamma-ray enrichment measurements on the Los Alamos National Laboratory standards and on the National Bureau of Standards (NBS) certified enrichment reference standards (NBS SRM-969). We consider in some detail both the theoretical and experimental considerations of doing accurate gamma-ray measurement of uranium enrichment, including particularly the extraction of the net area of spectral full-energy peaks, correction for dead-time and pileup losses, correction for the chemical composition of the measured materials, and correction for the attenuation in containers. We conclude that with proper procedures and careful work, gamma-ray enrichment measurements based on a minimum set of standards (perhaps only one of high enrichment) can be made over the whole range of enrichments $\geqq$0.7% with biases of $\leqq$0.1%. 6 refs., 34 figs., 8 tabs.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 4181, 4246, 4838, 5530, 5531, 5533, 5535, 5551

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 4222, 4534, 4827, 4876

4181 **(CONF-8711195—4) ^{252}Cf-source-driven neutron noise measurements of subcriticality for an annular tank containing aqueous Pu-U nitrate.** Mihalczo, J.T.; Blakeman, E.D.; Ragan, G.E.; Kryter, R.C.; Seino, H.; Robinson, R.C. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89001930/JAW.

From American Nuclear Society winter meeting; Los Angeles, CA, USA (15 Nov 1987).

Measurements of the subcritical neutron multiplication factor, k/sub eff/, using the ^{252}Cf-source-driven neutron noise analysis method were performed for an unreflected annular tank containing Pu-U nitrate solution but having the central region of the annulus void of significant materials. This experiment is part of a program of collaboration between the United States Department of Energy and the Power Reactor and Nuclear Fuel Development Corporation of Japan to study criticality safety related to the development of fast breeder technology. 3 refs.

4182 **(ND-R—1530(D)) Method for the separation of sodium and iron from plutonium and other impurities in concentrated plutonium solution and their subsequent measurement.** Mair, M.A.; Brown, M.L. (UKAEA Dounreay Nuclear Power Development Establishment). (UKAEA Northern Research Labs., Risley (UK)). Jun 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755485/JAW.

Sodium and iron are separated from plutonium and other impurities by solvent extraction. Sodium is determined by flame photometry and iron by spectrophotometric measurement of the orthophenanthroline complex.

4183 **Method of separating and recovering uranium and related cations from spent Purex-type systems.** Mailen, J.C.; Tallent, O.K. (to Dept. of Energy). US Patent Application 6-018,550. 25 Feb 1987. 15p. Contract AC05-84OR21400. DE89000096 NTIS, PC A03/MF A01. Order Number DE89000096/JAW.

A process for separating uranium and related cations from a spent Purex-type solvent extraction system which contains degradation complexes of tributylphosphate wherein the system is subjected to an ion-exchange process prior to a sodium carbonate scrubbing step. A further embodiment comprises recovery of the separated uranium and related cations. 5 figs.

0509 Transport And Storage

4184 **(LA-UR—88-3454) Mobile nondestructive examination and assay instruments.** Bieri, J.M.; Caldwell, J.T. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-880979—1). NTIS, PC A02/MF A01. Order Number DE89002127/JAW.

From American Society for Nondestructive Testing fall conference; Anaheim, CA, USA (19 Sep 1988).

A compact system that evaluates radioactive materials can furnish a big savings to taxpayers by ensuring that only properly identified nuclear waste is sent to a Department of Energy (DOE) radioactive waste storage area. The Los Alamos National Laboratory's Advanced Nuclear Technology Group has developed and field tested two easily transportable, self-contained modules: one performs real-time radiography of special 208-{l} shipment containers, the other assays the contents. The examination and assay system is a simple, portable solution to a complex problem that ensures only properly packaged transuranic (TRU) waste is

shipped to the Department of Energy's Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. 3 refs., 6 figs.

0520 Waste Management

REFER ALSO TO CITATION(S) 4227, 4498, 4764, 4856, 5213, 5261

4185 (ACIESP—60-Vol.4, pp 330-333) **Quality assessment of immobilized wastes.** Rzyski, B.M.; Suarez, A.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

A final repository concept for LLW and ILW is being studied in Brazil. It is thus now possible to assess in a systematic way the requirements on the waste packages in each step of the treatment, conditioning, storage, transport, disposal and the quality control procedure needed to show the requirements are fulfilled. The methodology to perform this assessment is discussed in this paper. The results of this methodology is proposed as basis for the licencing of the disposal of different waste packages in Brazil.

4186 (ACIESP—60-Vol.4, pp 348-353) **Status of radioactive waste management and disposal in Brazil.** Suarez, A.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

Discussions are made concerning the Brazilian policy and the research and development program undertaken by IPEN, at Sao Paulo to the treatment and conditioning of nuclear wastes. (E.G.).

4187 (ACIESP—60-Vol.4, pp 345-347) **Evaluation of the processes used for the treatment of the hospital radwastes containing Cs-137.** Peres, S.S.; Silva, J.J.G. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

This work presents a resume of results obtained in the treatment of radwastes containing Cs-137 from HNMD (Hospital Naval Marcilio Dias) and IRD (Instituto de Radioprotecao e Dosimetria), due to the radiological accident of Goiania.

4188 (ACIESP—60-Vol.4, pp 334-338) **Statistical considerations on waste packages.** Suarez, A.A.; Rodrigues, D.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The requirements of the optimization component of the system of dose limitation establishes that planning, designing, using or operating sources and practices at any level of the nuclear fuel cycle or outside of it shall be performed in such a manner that exposures are as low as reasonably achievable and social factor being taken into account. Statistical criteria to guarantee some aspects of the packing and transport of the low- and intermediate-level radioactive wastes are proposed and discussed.

4189 (ACIESP—60-Vol.4, pp 354-358) **Radioactive wastes: technical solutions perspectives.** Franzen, H.R. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

During two decades all final radioactive products arising from nuclear research centers, radioisotope production and their applications in medicine/industry/agriculture were released into environment because their activity on specific activities were below the standard limits. However, after the Brazilian Programme creation the facilities in operation and others planned are producing or will generate several types of radioactive wastes that should be necessary to isolate the low-intermediate level wastes from human activities. To offer recommendations concerning the most convenient waste disposal options to national authorities the National Nuclear Energy Commission organized the research/development/demosntration project whose effots are dedicated to site selection and research/experiments. This paper describes briefly the waste generation, the first site selection studies and the waste disposal conception.

4190 (BMI/ONWI/C—312) **Waste package/repository impact study: Final report.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation; Fluor Technology, Inc., Irvine, CA (USA). Advanced Technology Div.). Sep 1985. Contract AC02-87CH10290;AC02-83WM46656. 350p. H. Order Number TI89000050/JAW.

The Waste Package/Repository Impact Study was conducted to evaluate the feasibility of using the current reference salt waste package in the salt repository conceptual design. All elements of the repository that may impact waste package parameters, i.e., (size, weight, heat load) were evaluated. The repository elements considered included waste hoist feasibility, transporter and emplacement machine feasibility, subsurface entry dimensions, feasibility of emplacement configuration, and temperature limits. The evaluations are discussed in detail with supplemental technical data included in Appendices to this report, as appropriate. Results and conclusions of the evaluations are discussed in light of the acceptability of the current reference waste package as the basis for salt conceptual design. Finally, recommendations are made relative to the salt project position on the application of the reference waste package as a basis for future design activities. 31 refs., 11 figs., 11 tabs.

4191 (CEA-DAS—495) **Evaluation of the risk associated with the storage of radioactive wastes. The deterministic approach.** Lewi, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 26p. (CONF-8805221—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755334/JAW.

From Seminar on the evaluation of the risks associated with the storage of radioactive wastes; Ispra, Italy (30 May 1988).

Radioactive waste storage facility safety depends on a certain number of barriers being placed between the waste and man. These barriers, certain of which are articial (the waste package and engineered barriers) and others are natural (geological formations), are of characteristics suited to the type of storage facility (surface storage or storage in deep geological formations). The combination of these different barriers provide protection for man, under all circumstances considered plausible. Justification, for the storage of given quantities of radionuclides, of the choice of the site, the artificial barriers and the overall storage architecture, is obtained by evaluation of the risk. It being this which provides a basis for determining the acceptability of the storage facility. One of the following two methods is normally used for evaluation of the risk: the deterministic method and the probabilistic method. This adress describes the deterministic method. This method is employed in France for the safety analysis of the projects and works of ANDRA, the national agency responsible for the management of radioactive waste. It should be remembered that in France, the La Manche surface storage centre for low and medium activity waste has been in existence since 1969, close to the reprocessing plant at La Hague and a second surface storage centre is to be commissioned around 1991 at Soulaines in centre of France (departement de l'Aube). Furthermore, geological surveying of four sites located in geological formations consisting of granite, schist, clay and salt were begun in 1987 for the selection in about three years time of a site for the creation of an underground laboratory. This could later be transformed, if safety is demonstrated, into a deep storage centre.

4192 **(CONF-881186—2) Karst subsidence in East Tennessee.** Ketelle, R.H.; Newton, J.G.; Tanner, J.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01. Order Number DE89002326/JAW.

From 2. conference on environmental problems in karst terranes; Nashville, TN, USA (16 Nov 1988).

Waste disposal site selection and facility design in regions dominated by carbonate bedrock must carefully consider karst development and the factors which contribute to subsidence activity. The Department of Energy's (DOE) Oak Ridge National Laboratory has completed a three phase study of karst subsidence in East Tennessee to quantify historical subsidence activity. The purpose of the study was to determine the principal factors which cause karst subsidence in the region. Techniques used and results obtained in this study form a basis for more detailed risk assessment at the local scale within the region. As development pressures diminish available land for various uses, risk-based land use decisions must be made to site critical facilities. To fulfill the study objectives a three phase study was designed including, (1) collection of subsidence data and compilation of a database, (2) performance of detailed studies of subsidence in three, two-to-five square-mile areas, and (3) synthesis of data obtained to; quantify the predominant sinkhole collapse dimensions, and identify events prior to subsidence or collapse events which may have caused the event, and estimate the intensity of subsidence as a function of geologic unit within subregional areas of higher and lower subsidence risk. 4 refs., 7 figs., 2 tabs.

4193 **(CORR—860401) Modeling of waste sites at the Savannah River Plant using the PATHRAE computer code.** Merrell, G.B.; Rogers, V.C. (Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)). Sep 1986. Contract AC09-76SR00001. 65p. (RAE—8511-31). NTIS, PC A04/MF A01. Order Number DE89002420/JAW.

The PATHRAE computer code was used for the contaminated transport, exposure assessment, and human health risk analyses to provide an accepted, broadly applicable and cost efficient method for use on all of the waste sites. The PATHRAE model was developed for performance assessment of low-level radioactive waste disposal technologies. It is a multiple pathway transport and risk assessment code designed to analyze, as a function of time, the exposure doses and resulting health effects to critical population groups and to the off-site population. Recent extensions of the PATHRAE code have permitted the analysis of chemically toxic contaminants, as well as radioactive contaminants, in the various environmental pathways. The types of SRP waste sites analyzed include seepage basins, retention basins, shallow land burial sites, rubble piles, and spill areas. The operational history of the sites varies from over 30 years for some of the solid waste sites and basins, to nearly instantaneous releases for the spill areas. 6 refs., 13 figs., 4 tabs.

4194 **(DOE/RL—88-22) Management perspective on possible payment options for defense high-level waste disposal fees.** (Pacific Northwest Lab., Richland, WA (USA); USDOE Richland Operations Office, WA). Sep 1988. Contract AC06-76RL01830. 66p. (PNL—6720). NTIS, PC A04/MF A01. Order Number TI89003420/JAW.

The Department of Energy intends to send the high-level radioactive waste from operations related to the production of defense materials to combined civilian/defense repositories for disposal. The federal government must pay a fee to cover its fair share of the cost for the disposal system. This report provides a management perspective on the issues associated with the fee payment schedules for defense high-level waste disposal and provides an objective, preliminary analysis of the options that are being considered, indicating the tradeoffs for each option. 6 refs., 4 figs.

4195 **(DOE-RW—88.013) Study of the behaviour of inorganic ion exchangers in the treatment of medium active effluents. Part IV. Further studies on absorber performance.** Beaven, G.W.; Cross, J.E.; Hooper, E.W. (UKAEA Harwell Lab. Chemistry Div.). (Department of the Environment, London (UK)). 1988. 109p. (AERE-G—4381). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755440/JAW.

This report summarises some of the results from an ongoing experimental programme of work for the Department of the Environment on the potential use of inorganic ion exchangers for the treatment of medium active waste streams. Six different absorbers have been examined for their effectiveness in removing Am, Cs, Co, Sb, Ru, Eu, Ag, Zr, Nb, Zn and Mn ions from solutions varying from 4 M HNO/sub 3/ to 1 M NaNO/sub 3/ at pH 10. The ion exchangers tested were polyantimonic acid, hydrous titanium oxide, manganese dioxide, potassium copper hexacyanoferrate II, titanium phosphate and zirconium phosphate. The experimental results show that by suitable choice of absorber and operating conditions, good decontamination from all the radionuclides examined can be achieved.

4196 **(DOE-RW—88.069) Role of equilibrium leach testing in understanding the behaviour of nuclear wastes under disposal conditions.** Biddle, P.; Rees, J.H. (UKAEA Harwell Lab. Chemistry Div.; Department of the Environment, London (UK)). 1988. 34p. (AERE-R—12646; ILWRP—87/P04). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755441/JAW.

Results from the equilibrium leach testing of a range of intermediate level nuclear wastes have been modelled using sorption and solubility data obtained in experiments with individual radionuclides. The wastes involved were AGR hulls, Magnox cladding wastes, combustible plutonium-contaminated materials and ferric/aluminium hydroxide flocs. The test has an important role in validating near-field models, and helps to build confidence in disposal assessments.

4197 **(DOE-RW—88.099) Feasibility of deep ocean disposal of heat generating waste. V.1. Overview of feasibility.** Hemming, C.R.; Freeman, T.J. (Department of the Environment, London (UK). Radioactive Waste (Professional) Div.; Building Research Establishment, Watford (UK)). (Department of the Environment, London (UK)). Jun 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756021/JAW.

This report summarises the research performed in the UK during the period 1977 to 1987 as part of the international programme investigating the feasibility of ocean disposal of heat generating radioactive waste. This study has involved: (i) the definition of the disposal operations needed to meet the minimum requirements for safely emplacing waste on or under the floor of the deep ocean; (ii) the identification and characterisation of areas of the deep ocean that might be suitable for containing heat generating waste; (iii) a study of the processes by which radionuclides might migrate through the multiple barriers that isolate the waste from man's environment; and (iv) a calculation of the radiological impact of the conceptual deep ocean repository. It is concluded that, from a technical and scientific viewpoint, disposal of heat generating waste in the deep ocean could provide a safe, economic and feasible alternative to deep disposal on land.

4198 **(DOE/WIPP—87-004) Compilation of historical radiological data collected in the vicinity of the WIPP site.** Bradshaw, P.L.; Louderbough, E.T. (Westinghouse Electric Corp., Carlsbad, NM (USA)). 1987. Contract AC04-86AL31950. 79p. NTIS, PC A05/MF A01. Order Number TI89002776/JAW.

The Radiological Baseline Program (RBP) at the Waste Isolation Pilot Plant (WIPP) has been implemented to characterize the radiological conditions at the site prior to receipt of radioactive wastes. Because southeastern New Mexico was the site of an underground nuclear test in 1961, various sampling programs have intermittently monitored background and elevated radiation levels in the vicinity of the WIPP. In addition, radiological characterization of the site region was performed during the 1970's in support of the WIPP Environmental Impact Statement. The historical data are drawn primarily from monitoring activities of the US Public Health Service (PHS), the Environmental Protection Agency (EPA), US Geological Survey (USGS) and Sandia National Laboratories, Albuquerque (SNLA). Information on air and water quality, meat, milk, biota and vegetation is included in the report. This survey is intended to provide a source of reference for historical data on ra-

diological conditions in the vicinity of the WIPP site prior to the establishment of a systematic Radiological Baseline Program. 31 refs., 1 fig.

4199 **(DOE/WIPP—87-007) Department of Energy Operation Quality Assurance Program for the Waste Isolation Pilot Plant (WIPP) Project (Carlsbad, New Mexico).** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Dec 1987. Contract AC04-86AL31950. 23p. NTIS, PC A03/MF A01. Order Number DE89002772/JAW.

The purpose of this plan is to describe the Quality Assurance (QA)← Program to be established and implemented by the US Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Project Office (WPO) and by the Project Participants: the Scientific Advisor (Sandia National Laboratory) and the Management and Operating Contractor (Westinghouse Electric Corporation). This plan addresses the Pre-Operational and Operational phases of the WIPP Project not addressed under the construction phase. This plan also requires the QA Programs for DOE and Project Participants to be structured so as to comply with this plan and ANSI-ASME NQA-1. The prime responsibility for Operational Quality Assurance rests with the DOE WIPP Project Office and is implemented through the combined efforts of the Scientific Advisor and the Management and Operating Contractor. Overviews of selected operational and testing activities will be are conducted in accordance with prescribed requirements and that adequate documentation of these activities is maintained. 4 figs.

4200 **(DOE/WIPP—87-016) A plan for the implementation of assurance requirements in compliance with 40 CFR 191.14 at the Waste Isolation Pilot Plant.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Dec 1987. Contract AC04-86AL31950. 44p. NTIS, PC A03/MF A01. Order Number DE89002779/JAW.

The purpose of this document is to describe the Assurance Requirements Implementation Plan for the Waste Isolation Pilot Plant (WIPP). This Plan addresses the requirements that have been promulgated by the US Environmental Protection Agency (EPA) standard "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; Final Rule" (The Standard). It should be pointed out that portions of this standard have been vacated and remanded to the EPA by the First Circuit Court (NRDC vs EPA). The reasons for remanding were unrelated to the Assurance Requirement provisions. As a result, it is anticipated that when a new Standard is promulgated, the Assurance Requirements in the current Standard will remain intact. The Second Modification to the Consultation and Cooperation Agreement with the State of New Mexico acknowledges the necessity for continuing "as though the provisions remain applicable". The Plan will be revised as necessary in response to any changes in the Standard resulting from the court's decision. The WIPP Project was authorized by Public Law as a defense activity of the US Department of Energy (DOE) with the express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive wastes that result from defense activities of the US. The WIPP Project is exempted from regulation by the Nuclear Regulatory Commission (NRC). The mission of the WIPP Project is to conduct research, demonstration, and siting studies relevant to permanent disposal of transuranic (TRU) wastes. 4 refs.

4201 **(DOE/WIPP—88-011) Waste Isolation Pilot Plant (WIPP) startup plan.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Mar 1988. Contract AC04-86AL31950. 45p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003553/JAW.

To allow the Waste Isolation Pilot Plant (WIPP) to transition from a Major System Acquisition to an operating demonstration facility, the Acquisition Executive and the Energy System Acquisition Advisory Board (ESAAB) must concur in the facility's readiness to receive waste. This action, designated in DOE Order 4700.1 as Key Decision Four, concludes with the Chairman of the ESAAB issuing a Record of Decision. Since the meeting leading to the Record of Decision is scheduled for August 1988, plans must be made to ensure all activities contributing to that decision are completed in a clear and well-coordinated process. To support that effort, this Start-Up Plan was prepared to identify and track key events necessary to verify WIPP's readiness to receive waste; this provides a management/scheduling/tracking tool for the DOE WIPP Project Office (WPO) and a tracking mechanism for the DOE Albuquerque Operations Office (DOE-AL) and for DOE Headquarters (DOE-HQ); and describe the process to ensure readiness is documented by providing relevant data and reports to the cognizant decision makers. The methods by which these two purposes are achieved are discussed in further detail in the remainder of this plan.

4202 **(DOE/WIPP—88-013) Waste Isolation Pilot Plant RH TRU waste preoperational checkout: Final report.** (Westinghouse Electric Corp., Carlsbad, NM (USA). Waste Isolation Div.). Jun 1988. Contract AC04-86AL31950. 122p. NTIS, PC A06. Order Number DE89002762/JAW.

This report documents the results of the Waste Isolation Pilot Plant (WIPP) Remote-Handled Transuranic (RH TRU) Waste Preoperational Checkout. The primary objective of this checkout was to demonstrate the process of handling RH TRU waste packages, from receipt through emplacement underground, using equipment, personnel, procedures, and methods to be used with actual waste packages. A further objective was to measure operational time lines to provide bases for confirming the WIPP design through put capability and for projecting operator radiation doses. Successful completion of this checkout is a prerequisite to the receipt of actual RH TRU waste. This checkout was witnessed in part by members of the Environmental Evaluation Group (EEG) of the state of New Mexico. Further, this report satisfies a key milestone contained in the Agreement for Consultation and Cooperation with the state of New Mexico. 4 refs., 26 figs., 4 tabs.

4203 **(DP—1769) WIPP/SRL in situ tests: Part 3, Compositional correlations of MIIT [Materials Interface Interactions Test] waste glasses.** Ramsey, W.G.; Wicks, G.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1988. Contract AC09-76SR00001. 46p. NTIS, PC A03/MF A01. Order Number DE89003421/JAW.

The Materials Interface Interactions Test (MIIT) is the only in situ program involving the burial of simulated high-level waste-forms that is operating in the United States. Fifteen glass and waste-form compositions and their proposed package materials, supplied by seven countries, are interred in salt at the Waste Isolation Pilot (WIPP) in Carlsbad, New Mexico. A joint effort between Sandia National Laboratories and Savannah River Laboratory, MIIT is the largest and most internationally cooperative in situ venture yet undertaken. The objective of the current study is to document the waste-form compositions used in the MIIT program and then to examine compositional correlations based on structural considerations, bonding energies, and surface-layer formation. These correlations show important similarities between the many different waste glass compositions studied worldwide and suggest that these glasses would be expected to perform well and in a similar manner. The compositional correlations define a commonality between all MIIT waste-forms and assist in furthering our understanding of high-level waste glass performance. 16 refs., 12 figs., 2 tabs.

4204 **(DP-MS—88-58) Decontamination and coating of lead.** Rankin, W.N.; Bush, S.P.; Lyon, C.E.; Walker, V. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1988. Contract AC09-76SR00001. 15p. (CONF-881141—1). NTIS, PC A03/MF A01. Order Number DE88014928/JAW.

From Superfund '88: 9th national conference and exhibition on hazardous waste; Washington, DC, USA (28 Nov 1988).

Technology is being developed to decontaminate lead used in shielding applications in contaminated environments for recycle as shielding. Technology is also being developed to coat either decontaminated lead or new lead before it is used in contaminated environments. The surface of the coating is expected to be much easier to decontaminate than the original lead surface. If contamination becomes severely embedded in the coating and cannot be removed, it can easily cut with a knife and removed from the lead. The used coating can be disposed of as radioactive (hot hazardous)

waste. The lead can then be recoated for further uses as a shielding material. 4 refs., 5 figs., 4 tabs.

4205 **(ENEA-RT-PAS—87-24) Thermal conductivity measurement in Italian clay samples: needle probe method.** Blasi, L.; Girolimetti, G.; Polizzano, C.; Tassoni, E. (ENEA, Rome (Italy)). Apr 1988. 66p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755368/JAW.

With the aim of providing knowledge, useful for heat transfer studies related to the underground disposal of high-level radioactive wastes, this report presents an automated laboratory method to measure the thermal conductivity of clay samples. The method uses a needle and cylindrical probes made of stainless steel containing an electric resistance to heat the sample and a thermistor to measure the temperature rise. The automatic system has been used to measure the thermal conductivity of clay samples coming from different Italian quarries. The thermal conductivity values, which range from 1.4 to 2.1 W/m degrees Celsius, measured on the clay sedimentation plane, are higher than those measured along the direction perpendicular to it. Furthermore, the thermal conductivity measured in the samples decreases as the clay water content rises. No correlation between the thermal conductivity and the clay mineralogical composition has been observed.

4206 **(EPRI-NP—5933) 1986 EPRI radwaste workshop: Proceedings.** (Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA)). Oct 1988. 553p. (CONF-8602160—). Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002018/JAW.

From 8. EPRI radwaste workshop; Savannah, GA, USA (9 Feb 1986).

The proceedings of the eighth radwaste workshop are presented. The workshop presentations and discussion sessions addressed: Waste Minimization and On-Site Storage, Regulatory Issues, and Radwaste Equipment Operating Experience. Significant accomplishments in waste volume reduction and resultant cost savings were demonstrated by the actual results achieved with the implementation of dedicated management supported volume reduction programs at Brunswick and Crystal River Unit {number←sign}3. On-site storage implementation is being accomplished at the Duane Arnold Energy Center of Iowa Electric by construction of a low level radwaste processing and storage facility. The design of this facility was described. The regulatory lectures covered disposal site issues and an update on waste transportation regulations. Current regulatory issues were addressed by a representative of the NRC. The lectures on radwaste equipment operating experience discussed radwaste evaporator experience at Callaway, steam generator chemical cleaning waste processing at Millstone Unit {number←sign}2 and comparison testing of General Electric and Westinghouse-Hittman super compactors at Idaho National Engineering Laboratory. Individual papers were processed separately for the data base.

4207 **(EPRI-NP—5934) Proceedings: 1987 EPRI radwaste workshop.** Coplan, B.V. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA)). Oct 1988. 268p. (CONF-8707200—). Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002017/JAW.

From 9. EPRI radwaste workshop; Boulder, CO, USA (19 Jul 1987).

The proceedings of the ninth EPRI radwaste workshop are presented. The workshop presentations followed by discussion sessions addressed wet waste minimization, installed radwaste equipment improvements, and dry active waste volume reduction. Under wet waste minimization, the presentations included bodyfeed addition to condensate polishing, root cause analysis, precoat filter optimization and evaluation of selective ion exchange. Installed radwaste equipment improvement lectures discussed project management of radwaste retrofits, hollow fiber filters and the design and construction of a solidification and dewatering facility at the Farley nuclear plant of Alabama Power Co. Reduction of dry active waste volume included presentations on alternative disposal of very low level radioactive waste, the waste segregation program at River Bend, Florida Power and Light's radwaste minimization program and the radwaste minimization program at the H.B. Robinson station. The program also included updates on the EPRI Below Regulatory Concern program, the operations at the Beatty, Richland and Barnwell disposal sites and a presentation on the operational impact of regulatory policy on mixed waste. Individual papers were processed separately for the data base.

4208 **(GSF—8/87) Refined stratigraphy and facies of the Lower and Middle Bunter sandstone formation in the Remlingen 5 bore hole.** Paul, J.; Klarr, K. (Goettingen Univ. (Germany, F.R.). Inst. fuer Geologie und Palaeontologie). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Braunschweig (Germany, F.R.). Inst. fuer Tieflagerung). 1988. 153p. (In German). (GSF-TL—7/87). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755940/JAW.

The Remlingen 5 well was carried down from September 1983 to May 1984 in order to obtain better data on underground rock formation at this site which is at the southern border of the Asse salt anticline, with the coordinates R=44 08 717, H=57 77 743. The bore hole cut across strata of the Lower and Middle Bunter at a depth of 1676.5 m and 2071.5 m. This experiment at Remlingen 5 is the only site in North Germany where the Bunter sandstone was completely cored, and where numerous geophysical measurements could be made. With the available cores and logs, the Lower and Middle Bunter's fine stratigraphy was established and the depositional environments of the different strata were defined.

4209 **(HCR-CDM—04) Hydrocarbons conversions over mineral ion-exchangers used in uranium ore waste treatment.** Azzouz, A. (Commissariat aux Energies Nouvelles, Algiers (Algeria). Centre de Developpement de Materiaux). May 1988. 2p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704328/JAW.

Preliminary experiments were carried out in order to investigate catalytic activities in hydrocarbons reactions of natural and synthetic zeolites previously loaded with heavy elements as lanthanides and actinides in yellow cake treatment. This way could be considered as an interesting low coast alternative in revalorifying these mineral ion-exchangers.

4210 **(INIS-mf—11856) Ultimate storage of thorium-bearing waste. Final report. Reporting period July 1, 1984 to July 31, 1985.** Ganser, B. (Nuklear-Chemie und -Metallurgie G.m.b.H. (NUKEM), Hanau (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jan 1986. 38p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755961/JAW.

The goal of this R and D project was to experimentally determine the release of the radioactive noble gas radon from thorium-bearing waste. For the experiments, three 200 litre waste forms have been prepared: One package consisting of inactive cement (for blank value determination), the second of cemented, radioactive sludge precipitate (for reference value determination), and the third of untreated sludge precipitate in a drum. The release rate measured on the reference package at room temperature is 3.1x10/sup 10/ Bq/a for Rn-220, and 2.4x10/sup 6/ Bq/a for Rn-222. The release rate from a drum under equal conditions is 4.1x10/sup 8/ Bq/a for Rn-220, and 2.1x10/sup 6/ Bq/a for Rn-222.

4211 **(KFK—4467) Studies of dynamic and static leaching of cemented and uncemented sorption material loaded with iodine-129.** Furrer, J.; Kaempffer, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Sep 1988. 15p. (In German). (PWA—37/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755975/JAW.

Leaching tests with water and brines were conducted on Ac 6120 iodine sorption material (12 wt.% Ag) in order to improve the assessment of the behavior of radioactive waste stored in a repository mine (salt or iron ore.). As a result of the dynamic and static

leaching tests, the leached fraction of I-129 in the uncemented material was found to be < 10/sup -1/%, while that of the cemented iodine sorption material was found to be < 10/sup -2/%. After ordinary steel had been added to the cemented sorption materal, the leached fractions found were identical to those measured in uncemented material. The addition of stainless steel had only little influence on the leached fraction.

4212 **(NAGRA-NTB—82-04) Preparation of bentonites for laboratory investigations.** Mueller-Vonmoos, M.; Kahr, G. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Apr 1982. 17p. (In German). Nagra, CH-5401 Baden, Switzerland.

A project study on behalf of Nagra for high radioactive waste disposal in deep geological formations as well as literature studies have shown that bentonite could be a suitable filling and sealing material. The Institute for Foundation and Soil Mechanics of the Swiss Institute of Technology has been given a contract by Nagra to investigate different bentonites. The investigations concentrate on the Na-bentonite MX-80 from Wyoming, which is foreseen by the Swedes, and on the geographically more favorable Ca-bentonite Montigel from Bavaria. Montigel powder and granulate, which show certain manufacturing advantages, were investigated. The quality of the bentonites was examined especially to ascertain whether the bentonites were homogeneous with respect to composition and properties. Montmorillonite, carbonate, oxidizing substances and exchangeable ions were quality content criteria for bentonite. The investigations showed that these bentonites are typical Na- and Ca-bentonites. A representative sample of 500 kg weight (250 kg for Montigel K) was largely homogeneous. The samples were analysed by x-rays and thermoanalysis. Additionally grain size, carbonate content, methylene blue value, yield point, exchange capacity and exchangeable ions were determined. 5 refs., 2 figs., 2 tabs.

4213 **(NSS/G—107) Nirex Safety Assessment Research Programme bibliography, 1988.** Cooper, M.J. (UKAEA Harwell Lab. Materials Physics and Metallurgy Div.; comp.). (United Kingdom Nirex, Ltd., Harwell). May 1988. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755443/JAW.

This bibliography lists reports and papers written as part of the Nirex Safety Assessment Research Programme, which is concerned with disposal of low-level and intermediate-level waste (LLW and ILW) and associated radiological assessments. All work referred to has been funded, or partly funded, by UK Nirex Limited, previously known as the Nuclear Industry Radioactive Waste Executive (NIREX). The bibliography has been divided into two sections, a List of Publications in roughly chronological order and an Auther Index. The topics involved include near-field and far-field studies. The near-field includes the waste, its immobilising medium, its container, the engineered structure in which the containers are emplaced, and the immediately adjacent geological formation disturbed by the construction of the repository. The far-field is the undisturbed geological formation between the near-field and the biosphere.

4214 **(NUREG/CR—5240) Comparative evaluation of selected continuum and discrete-fracture models: Emphasis on dispersivity calculations for application to fractured geologic media, creston study area, eastern Washington.** Kunkel, J.R.; Way, S.C.; McKee, C.R. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; In-Situ, Inc., Laramie, WY (USA)). Nov 1988. 68p. NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89003018/JAW.

A quantitative comparison of dispersivity calculated from a discrete-fracture model and an analytical solution for fractured rock is made. The calculated transverse dispersivity from an analytical solution to the dispersion equation is compared to that from a discrete-fracture model for four cases involving two sets of parallel, planar, continuous fractures intersecting at various angles. Anisotropy is used in one of the cases. Results of the comparison indicated that the functional relationships of transverse dispersivity were preserved by both models when the angle of the hydraulic gradient changed with respect to the two fracture sets, the spacing between fractures changed, the angle between fracture sets changed, or the hydraulic properties of one of the fracture sets changes. The magnitude of the calculated transverse dispersivity using the discrete-fracture model was within 10% of that calculated using the analytical solution after the scale effects of the fracture system were taken into account. The results demonstrate that dispersivity calculated by a discrete-fracture model agrees well with theory. Scale effects of transverse dispersivity indicated that a relatively constant value was reached after particles had traveled about 10 times the fracture spacing of the most widely spaced fracture family. 41 refs., 21 figs., 2 tabs.

4215 (OEVS-Mitteilung—1/1988, pp 33-42) **Release of radioactive materials with the waste water from the Atom Institute of the Austrian universities.** Buchtela, K. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

Liquid effluents of the Atomic Institute of the Austrian Universities are collected by two separate systems to feed the radioactive liquid waste from the laboratories to a waste treatment plant. The storage capacity of this plant is 60 m/sup 3/. Short lived radionuclides are stored for decay, precipitating and filtering facilities are for further treatment. To minimize the amount of liquid waste in the plant, waste collection is done also in the laboratories on the spot using special containers. All the releases of radioactive materials due to the operation of the reactor and the laboratories had been far below any authorized limits because of careful selection of radionuclide application techniques and adequate waste management procedures. 3 refs., 3 figs., 1 tab.

4216 **(ORNL/TM—10664) Tritium effluent reduction at Oak Ridge National Laboratory.** Shor, J.T. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01. Order Number DE89003084/JAW.

A study has been performed to determine the most cost-efficient technologies available to reduce the airborne emissions of tritium (T_2) from the Oak Ridge National Laboratory (ORNL) in accordance with the principles of "as low as reasonably achievable" (ALARA) dose equivalents to the population. Extensive consultations with other Department of Energy (DOE) laboratories and other tritium handling facilities in the United States and Canada have been conducted. Substantials reductions in tritium emissions can be made to bring ORNL within the range of emissions from other DOE laboratories. Equipment and methods are available in the form of (1) modern and versatile oilless vacuum pumps, (2) small-angle, stack-gas tritium effluent removal systems, and (3) process operations management techniques, which can reduce the releases of tritium to the atmosphere without creating additional radiation exposure on the ground. The equipment costs, not including engineering and installation for each tritium handling facility at ORNL, are estimated to be between $17,500 and $75,000, depending on the level of complexity of the system. 32 refs., 7 figs., 2 tabs.

4217 **(PNL—6725) Considerations of a nonhomogeneous fluid in the deep groundwater flow system at Hanford.** Nelson, R.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 85p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003725/JAW.

This report presents such a general theory capable of describing the flow on nonhomogeneous fluids in porous media, theory that is a composite from several disciplines including groundwater hydrology, soil physics, civil engineering, petroleum reservoir engineering, mechanics, and mathematical physics. The report discussed the conceptual basis for considering the flow of nonhomogeneous fluids. From this conceptual basis emphasis shifts to providing complete definitions and then appropriately describing those definitions in mathematical terms. Throughout the report, the necessary assumptions are stated in detail because the limitations of any theory are best assessed through careful scrutiny of the assumptions. From the mathematical definitions with appropriate function-

al dependence the results and constraints needed are derived to provide the general theory necessary to describe the flow of nonhomogeneous fluids in porous media. Particular attention is given to comparing the general theory with the classical theory of flow for a homogeneous fluid. Such comparison provides significant insight to the effects of variable fluid properties on subsurface flow systems. The comparisons also indicate the importance of carefully formulating subsurface flow models within the more general theoretical framework describing the flow of nonhomogeneous fluids in porous media. 29 refs.; 6 figs.; 1 tab.

4218 **(PNL-SA—14892) Characterization of the atmospheric pathway at hazardous waste sites.** Droppo, J.G. Jr.; Buck, J.W. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 10p. (CONF-881054—33). NTIS, PC A03/MF A01. Order Number DE89002358/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Evaluation of potential health effects for populations surrounding hazardous waste sites requires consideration of all potential contaminant transport pathways through groundwater, surface water, and the atmosphere. A comprehensive pathway model that includes emission, dispersion, and deposition computations has been developed as a component of the Remedial Action Priority System (RAPS). RAPS is designed to assess the relative potential risks associated with hazardous and radioactive mixed-waste disposal sites. The atmospheric component includes optional volatilization and suspension emission routines. Atmospheric transport, dispersion, and deposition are computed using relatively standard modeling techniques expanded to incorporate topographical influences. This sector-averaged Gaussian model accounts for local channeling, terrain heights, and terrain roughness effects. Long-term total deposition is computed for the terrain surrounding the hazardous waste site. An example is given of applications at a US Department of Energy site, where atmospheric emissions are potentially important. The multiple applications of RAPS have provided information on the relative importance of different constitutent transport pathways from a potential population risk basis. Our results show that the atmospheric pathway is often equally as important as other pathways such as groundwater and direct soil ingestion. 6 refs., 3 figs., 4 tabs.

4219 **(PNL-SA—16150) Environmental monitoring at the US Department of Energy's Hanford Site, Washington.** Gray, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 12p. (CONF-881054—29). NTIS, PC A03/MF A01. Order Number DE89001994/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Environmental monitoring objectives are to detect and assess potential impacts of site operations on air, surface and ground water, foodstuffs, fish, wildlife, soil and vegetation. Data from monitoring effects are used to calculate the overall radiological impact to humans working onsite or residing in nearby communities, and to assess the impact of Hanford operations on the environment. In 1987, measured Hanford Site perimeter concentrations of airborne radionuclides were below applicable DOE and Environmental Protection Agency guidelines. Tritium and nitrate continued to be the most widespread constituents in onsite ground water. Chromium, cyanide, fluoride, and carbon tetrachloride were found in groundwater wells near operating areas. Concentrations of radionuclides and nonradiological water quality in the Columbia River at a municipal water intake were in compliance with applicable standards. Foodstuffs irrigated with river water taken downstream of the Site showed low levels of radionuclides that were similar to concentrations found in foodstuffs from control areas not irrigated with Columbia River water. Low levels of strontium-90 and cesium-137 found in some onsite wildlife samples were typical of those attributable to worldwide fallout as were low concentrations of radionuclides found in soils and vegetation from onsite and offsite locations. The calculated dose potentially received by a maximally exposed individual in 1987 (0.05 mrem/yr) was similar to that calculated for 1985 and 1986. Measured exposure to penetrating radiation and calculated radiation doses to the public from 1987 Hanford operations were well below applicable regulatory limits. 25 refs., 2 figs.

4220 **(SAND—88-2869C) ANS/ENS tutorial session: Burnup credit issues in spent fuel transportation: Overview and objectives.** Sanders, T.L. (Sandia National Labs., Albuquerque, NM (USA)). 2 Nov 1988. Contract AC04-76DP00789. 12p. (TTC—0875; CONF-881169—3). NTIS, PC A03/MF A01. Order Number DE89001852/JAW.

From American Nuclear Society winter meeting; Washington, DC, USA (1 Nov 1988).

A number of opportunities exist to increase the efficiency of the next generation of spent fuel shipping casks. Improving cask efficiency will not only reduce life cycle transportation costs, but also is consistent with maintaining public and occupational radiological risks and, more importantly, total risks (radiological and nonradiological) within the guidelines of the "as low as reasonably achievable" (ALARA) philosophy. Increases in cask capacities will reduce both the total number of shipments required to transport a given amount of fuel and the number of handling operations at both shipping and receiving facilities. Additional capacity increases can be achieved by implementing various design strategies based on new concepts and/or the actual characteristics of the majority of the spent fuel to be shipped in the future. For example, it has been determined that additional capacity increases can be achieved by taking credit for burnup, the reduced reactivity that results when fuel has been used to produce power in a nuclear reactor. That is, as the fuel is used the atoms of fissile material decrease, and neutron absorbers (or "poisons") that tend to retard the fission process are produced. 7 refs., 1 fig.

4221 **(UCID—21294) Estimates of the hydrologic impact of drilling water on core samples taken from partially saturated densely welded tuff.** Buscheck, T.A.; Nitao, J.J. (Lawrence Livermore National Lab., CA (USA)). Sep 1987. Contract W-7405-ENG-48. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003730/JAW.

The purpose of this work is to determine the extent to which drill water might be expected to be imbibed by core samples taken from densely welded tuff. In a related experimental study conducted in G-Tunnel, drill water imbibition by the core samples was observed to be minimal. Calculations were carried out with the TOUGH code with the intent of corroborating the imbibition observations. Due to the absence of hydrologic data pertaining directly to G-Tunnel welded tuff, it was necessary to apply data from a similar formation. Because the moisture retention curve was not available for imbibition conditions, the drainage curve was applied to the model. The poor agreement between the observed and calculated imbibition data is attributed primarily to the inappropriateness of the drainage curve. Also significant is the value of absolute permeability (k) assumed in the model. Provided that the semi-log plot of the drainage and imbibition moisture retention curves are parallel within the saturation range of interest, a simple relationship exists between the moisture retention curve, k, and porosity ({phi}) which are assumed in the model and their actual values. If k and {phi} are known, we define the hysteresis factor λ to be the ratio of the imbibition and drainage suction pressures for any saturation within the range of interest. If k and {phi} are unknown, λ also accounts for the uncertainties in their values. Both the experimental and modeling studies show that drill water imbibition by the core has a minimal effect on its saturation state. 22 refs., 6 figs., 2 tabs.

4222 **(UCID—21542) Plutonium Residue Recovery (PuRR) project: Quarterly progress report, April-June 1988.** Pittenger, L.C.; Alire, R.M.; Coops, M.S.; Landrum, J.H.; Priest, R.E.; Thompson, D.S.; Gregg, D.W.; Burris, L.; Pierce, R.D.; Morrissey, L.J. (Lawrence Livermore National Lab., CA (USA)). 24 Oct 1988. Contract W-7405-ENG-48. 15p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002823/JAW.

A major activity during this period was the conduct of a technical review of the PuRR process before a panel of persons having expertise in residue recovery. The results of the review were favorable as to the assessment of the feasibility of the project, and the reviewers also made valuable suggestions regarding the direction of specific activities in its support. In the area of process development, several variations on initial reduction processes have been conceived and are being explored. Laboratory-scale demonstration-of-feasibility experiments continue at ANL, with further in-

vestigation of reductions from ash and from LECO crucibles. ANL is also investigating reduction over a Cu--Mg alloy, and the effects of Si and Al on the solubility of Pu in this alloy, which is proposed as the donor alloy for a subsequent salt-transport step. Some preliminary work on chlorination as a head-end step, either to form volatile chlorides of Al and Si, or selectively to chlorinate Pu, was also initiated. At LLNL, progress was made toward reactivating the Bldg. 332 (Plutonium Facility) laboratory for experiments, and with writing and issuing procedures and emergency procedures for the gloveboxes and gas purification system. In the area of engineering support for laboratory feasibility demonstrations, a Preliminary Design Review for the initial laboratory-scale hardware was held, and several tasks necessary for reactivating the gloveboxes were completed. Preliminary material balances, as recommended by the technical reviewers, have been prepared as part of the project's process engineering effort. 2 refs., 4 figs.

4223 **(USGS-BULL—1790) Geologic and hydrologic investigations of a potential nuclear waste disposal site at Yucca Mountain, southern Nevada.** Carr, M.D.; Yount, J.C. (eds.). (Geological Survey, Denver, CO (USA)). 1988. Contract AI08-78ET44802. 152p. NTIS, PC A07/MF A01 - USGS Federal Center, Box 25425, Denver, CO 80225. Order Number TI89003048/JAW.

Yucca Mountain in southern Nye County, Nevada, has been selected by the United States Department of Energy as one of three potential sites for the nation's first high-level nuclear waste repository. Its deep water table, closed-basin ground-water flow, potentially favorable host rock, and sparse population have made the Yucca Mountain area a viable candidate during the search for a nuclear waste disposal site. Yucca Mountain, however, lies within the southern Great Basin, a region of known contemporary tectonism and young volcanic activity, and the characterization of tectonism and volcanism remains as a fundamental problem for the Yucca Mountain site. The United States Geological Survey has been conducting extensive studies to evaluate the geologic setting of Yucca Mountain, as well as the timing and rates of tectonic and volcanic activity in the region. A workshop was convened by the Geologic Survey in Denver, Colorado, on August 19, 20, and 21, 1985, to review the scientific progress and direction of these studies. Considerable debate resulted. This collection of papers represents the results of some of the studies presented at the workshop, but by no means covers all of the scientific results and viewpoints presented. Rather, the volume is meant to serve as a progress report on some of the studies within the Geological Survey's continuing research program toward characterizing the tectonic framework of Yucca Mountain. Individual papers were processed separately for the data base.

4224 **(WHC-SA—0211) The Hanford Grout Treatment Facility: Environmental assurance in low-level waste disposal.** Allison, J.M.; Bergman, T.B. (Westinghouse Hanford Co., Richland, WA (USA)). Jun 1988. Contract AC06-87RL10930. 6p. (CONF-880903—43). NTIS, PC A02/MF A01. Order Number DE89001162/JAW.

From Spectrum '88: international topical meeting on nuclear and hazardous waste management; Pasco, WA, United States (11 Sep 1988).

The Hanford Grout Disposal Program is developing the technology required to dispose of 170,000 m^3 of low-level radioactive waste. The waste contains significant quantities of hazardous chemicals, which dictates meeting applicable requirements of RCRA and WAC 173-303. A cementitious grout matrix has been selected to immobilize the hazardous chemical and radioactive constituents in the waste. Preliminary testing has shown that the hazardous and toxic nature of the waste is significantly mitigated through immobilization in grout. The disposal system design takes into account the features required to ensure compliance with RCRA, as well as projected compliance with the long-term environmental protection requirements outlines previously. The components being used to ensure long-term protection, principally the gravel hydraulic barrier/diffusion break and the protective barrier, were chosen based on comparison with natural analogues. Disposal of a low-level, nonhazardous waste will be initiated in June 1988. Disposal of the higher activity hazardous wastes is currently scheduled to begin in fiscal year 1990. 1 fig., 2 tabs.

4225 **(WHC-SA—0348) Statistical techniques for characterizing single-shell tank wastes.** Jensen, L.; Liebetrau, A.M. (Westinghouse Hanford Co., Richland, WA (USA)). Jul 1988. Contract AC06-87RL10930. 35p. (CONF-8808153—1). NTIS, PC A03/MF A01. Order Number DE89002143/JAW.

From National Academy of Sciences single-shell tank waste characterization; Richland, WA, USA (1 Aug 1988).

To characterize the wastes stored in single-shell tanks (SSTs), it is necessary to estimate the errors in concentration measurements of radionuclides or chemical species of interest. Such measurements are influenced by the degree of in-tank heterogeneity of the wastes. A reference statistical sampling plan has been designed specifically to estimate variance components that measure tank waste heterogeneity. Under this plan, the significance of the individual variance components is determined by comparing them with the analytical error. Consequently, the success of the reference sampling plan is a function of the magnitude of the analytical error. This report outlines two methods for using the information from the reference sampling plan to reduce or minimize the number of observations needed to characterize waste in other SSTs. The two methods rely on the assumption that information obtained from one SST according to the reference sampling plan can be used to characterize the waste in other SSTs. It must be emphasized that before the proposed methods can be used with confidence, additional work is required to establish the validity of this assumption. Until data have been collected in accordance with the reference sampling plan, it is impossible to quantify the effect of waste heterogeneity on estimates of concentration or to determine the number of samples needed to characterize SST wastes. 3 refs., 1 fig.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 4190, 4192, 4193, 4194, 4196, 4198, 4199, 4200, 4201, 4202, 4203, 4206, 4207, 4216, 4217, 4218, 4219, 4220, 4221, 4223, 4224, 4908

4226 (ACIESP—60-Vol.4, pp 13-17) **Radiation application to environmental conservation and upgrading of wastes.** Takehisa, M. (Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The recent progress of radiation application in the environmental conservation and upgrading of wastes are presented. (E.G.).

4227 **(NAGRA-NTB—80-06) Influence of the transversal diffusion/dispersion on the radionuclide migration in porous media - investigation of analytically solvable problems for geological layer structures.** Schmocker, U. (2314000CH). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Jul 1980. 80p. (In German). Nagra, CH-5401 Baden, Switzerland.

Repositories in geological formations are planned for the final disposal of radioactive wastes produced by nuclear power. Generally, water entry leading to leaching of the waste matrix is considered as the critical process which can result in release of radionuclides from a waste repository. In risk analyses for waste repositories the migration of radionuclides through the geosphere is usually described mathematically by a one-dimensional transport model. On the other hand the hydrological calculational models used for determining the critical migration paths are invariably two- or three-dimensional. A one-dimensional transport calculation always gives conservative results for a specific migration path because the influence of the transverse dispersion/diffusion effect is neglected. This effect results in an additional decrease of the nuclide concentration along the migration path. On the other hand radionuclides can spread to adjacent geological formations which are not taken into account in a one-dimensional model. If the water velocities in these formations are higher than along the original (one-dimensional) migration path or if the distance to the biosphere (e.g. lake, river or well) is shorter, then the process of the transverse dif-

fusion/dispersion can represent an additional risk. The present work deals with the influence of the transverse diffusion/dispersion effect on the migration of radionuclides through the geosphere. We restrict ourselves to migration in porous media which is the standard approach of most existing transport models. For modelling the transport of radionuclides in fissured systems there exist only a few preliminary calculational approaches to date. We are mainly interested in analytically soluble problems which take into account the transverse diffusion/dispersion effect. This procedure permits investigation of the most important effects in a simple and direct manner. 17 refs., 36 figs., 2 tabs.

0540 Health And Safety

REFER ALSO TO CITATION(S) 4191, 4213, 5214

4228 (FMPC—2169) The removal of multi-curie amounts of radon from a confined space by absorption on carbon beds. Grumski, J.T.; Harmer, D.E. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1988. Contract AC05-86OR21600. 14p. (CONF-881054—35). NTIS, PC A03/MF A01. Order Number DE89002883/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

Two silos, designated as K-65, at the Feed Materials Production Center, Fernald, Ohio, contain from 1600 to 3800 curies of radium dispersed in sludges from the early days of uranium ore processing. Above the sludge bed in each silo, the confined air space has been found to contain up to 37 curies of radon in equilibrium with the radium-bearing material below. Preparations are now being made for treatment, stabilization, and disposal of these sludges. In this connection, it is necessary to open access ports occasionally to the atmosphere. To minimize releases of radon and to provide a significant reduction in personnel exposure, a radon adsorption system was designed and installed. It operates by pulling air from one side of the silo head-space, drawing it through calcium sulfate drying columns, then through activated carbon absorbers, and finally discharging it back into the opposite side of the silo. The circulation of the air is continued until the desired reduction in radon is achieved. Field experience with this system proved its effectiveness and established that it could be re-used after the initial charge of absorbed radon had decayed. It is believed that this is the largest scale application of adsorption ever attempted. 6 refs., 5 figs., 1 tab.

0550 Safeguards, Inspection, And Accountability

REFER ALSO TO CITATION(S) 4184

4229 (DOE/MA—0320(Vol.2)) Bibliography for computer security awareness and training. (Oak Ridge National Lab., TN (USA)). Feb 1988. Contract AC05-84OR21400. 203p. NTIS, PC A10/MF A01. Order Number DE89002480/JAW.

The purpose of this bibliography is to provide Computer Protection Program Managers (CPPM's) at DOE and DOE contractor sites a baseline reference document for obtaining unclassified computer security awareness and training (CSAT) materials. It is intended that the bibliography be used in conjunction with the Guideline for Development of Unclassified Computer Security Awareness and Training Programs. This material has also been prepared in ASCII format on a 5 1/4 in. floppy diskette to provide a file which may be maintained on-site allowing for updating, sorting, and retrieving the information in an automated fashion. Instructions on how to load the ASCII file into the appropriate data base file are enclosed with the floppy diskette jacket. This bibliography contains materials and information that are available concerning unclassified computer security. Standard bibliographic reference data is included along with a short abstract, the media form, and the category of information. Appendix A at the end of the bibliography lists the addresses of publishers and suppliers of the referenced sources.

4230 (INIS-mf—11313) Safety protection of nuclear facilities and nuclear materials. Lukavsky, J. (Ceskoslovenska Komise pro Atomovou Energii, Prague). Dec 1987. 17p. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704350/JAW.

Bezpecnost Jadernych Zarizeni.; (no.6).

Safety protection is discussed of nuclear facilities and of nuclear materials, which is a specific element of guaranteeing nuclear safety. Its task is to maximally restrict the risk of misuse of nuclear facilities and nuclear materials for endangering human lives and health and the environment. Concrete requirements for the barriers and technical means and for security of nuclear facilities and nuclear materials are based on this approach. In the CSSR, a legal norm is being prepared that will enact the said requirements for safety protection of nuclear facilities and nuclear materials. (Z.M.).

4231 (LA—11360-MS) Feasibility study on verification methods for bulk quantities of low-enrichment UO_3 powder. Menlove, H.O.; Sapir, J.L. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 27p. (ISPO—290). NTIS, PC A03/MF A01. Order Number DE89002106/JAW.

A feasibility study is presented for technical approaches to verify large ({approximately}250 kg) UO_3 containers. The low- enrichment uranium is typical of output from reprocessing plants. The methods considered in the study include passive-gamma-ray, passive-neutron, and active-neutron techniques. Monte Carlo calculations are used to model and evaluate the more promising active-neutron methods. The possible measurement methods are compared for accuracy, complexity, cost, and level of intrusiveness to the operator. 11 refs., 14 figs., 5 tabs.

4232 (MLM—3546) Measurement control in transportable gamma-ray systems used for measuring relative plutonium isotopic composition. Rakel, D.A. (EG and G Mound Applied Technologies, Miamisburg, OH (USA)). 30 Sep 1988. Contract AC04-76DP00053. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002468/JAW.

Measurement control procedures for measurements performed "in- field" require attention to details that are not usually issues for measurements performed in a stable laboratory environment. Some approaches to measurement control for in-field gamma-ray spectroscopy, developed during exercises for plutonium inventory verification, are presented. 7 refs., 3 tabs.

4233 (NBL—319) Safeguards Measurement Evaluation Program nuclear materials measurement data: Phase 1: Final report, 1985 through 1986. Cacic, C.G. (USDOE New Brunswick Lab., Argonne, IL). Aug 1988. 116p. NTIS, PC A06/MF A01. Order Number DE89002147/JAW.

The New Brunswick Laboratory has been tasked by the US Department of Energy Office of Safeguards and Security to assess and evaluate the adequacy of measurement technology as applied to materials accounting in US Department of Energy nuclear facilities. The Safeguards Measurement Evaluation Program was developed as a means to monitor and evaluate the quality and effectiveness of accounting measurements by site, material balance area, or unit process. Phase 1 of the Safeguards Measurement Evaluation Program, initiated during 1985, involved evaluation of the primary accountability measurement methods at six US Department of Energy Defense Programs facilities. Resulting data are presented and evaluated as indicators of current state-of-the-practice accountability measurement methodology, deficiencies in materials accounting practices, and areas for possible assistance in upgrading measurement capabilities. 22 figs., 5 tabs.

4234 (TsNIIAI-M—1-87) Possible procedures for IAEA safeguards at NPP with WWER-1000 reactor. Technical recommendations. Ermakov, S.V.; Pykhtin, Yu.D.; Bumblis, I.I.; Dukhovenskij, A.S.; Kulikov, Yu.K. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1987. 68p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704409/JAW.

Analysis of structural peculiarities of NPP with WWER-1000 type reactors, important from the viewpoint of IAEA safeguards procedure application, is carried out. The main elements of the approach to the IAEA safeguards implementation for the given facility, including the IAEA control aims, requirements to the organization of the system of nuclear material account and control at NPP with WWER-1000, are considered. Taking into account peculiarities of design and operation of the facility, possible ways of nuclear material diversion are analyzed. Technical means and devices necessary for the control procedure realization both in possession of IAEA and developed for the purposes in the framework of the USSR research and development support program for the IAEA safeguards are considered. Recommendations are made on possible IAEA safeguards procedures for NPP with WWER-1000, developed taking into account peculiarities of the facility considered, approach to safeguards implementation and technical means of control recommended for utilization. Labour consumption for the implementation of the IAEA inspection activities at the facility is assessed. Technical recommendations for the account of the IAEA safeguards procedure requirements to the design of NPP with WWER-1000 are given so as to increase the efficiency of the IAEA control measures. 28 refs.; 14 figs.; 6 tabs.

0560 Legislation And Regulations

REFER ALSO TO CITATION(S) 4474, 4474

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

4235 **(INIS-SU—58) Radiation technology. Scientific-technical collection.** Shtan's, A.S. (Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1987. 87p. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Individual papers in this collection are indexed separately. (LEW)

0701 Physical Isotope Separation

4236 **(K/ITP—156/P2/R1) Nuclear material safeguards for enrichment plants: Part 2, Cascade and centrifuge separation theory; Uranium hexafluoride: Safeguards training course.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oct 1988. Contract AC05-84OT21400. 367p. (ISPO—284/P2/R1; CONF-881199—Pt.2-Vugraphs). NTIS, PC A14/MF A01. Order Number DE89002377/JAW.

From Safeguards training course: nuclear material safeguards for enrichment plants; Vienna, Austria (14 Nov 1988).

Since most isotope separation processes for uranium enrichment have small stage separation factors or limited throughput, a problem that must be faced in making the processes useful is how to arrange process equipment effectively and efficiently to accomplish the needed separation. The design of real separation systems (or enrichment plants) is related to elementary process factors such as separation factor, cut, and throughput. Nuclear criticality is not discussed, although it imposes limits on the design of facilities. Physical, chemical, and toxic properties of UF_6 are discussed. UF_6 criticality considerations and safeguards implications are also examined. The last section of this report provides an explanation of the design and operation of a gas centrifuge as used in the enrichment process.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 4466, 4826, 5566

4237 **(CONF-8810182—5) The US Advanced Neutron Source.** West, C.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01. Order Number DE89002213/JAW.

From International collaboration on advanced neutron sources (ICANS); Los Alamos, NM, USA (3 Oct 1988).

The Advanced Neutron Source (ANS) is to be a new user experimental facility for all fields of neutron research. The most important scientific justification for the ANS Project is to provide intense beams of neutrons for scattering and other experiments: neutron scattering is a primary tool of basic and applied materials science. Facilities will also be provided for engineering materials irradiation tests, isotope production (including transplutonium elements), and materials analysis. More than 1000 users per year are expected to carry out experiments at the ANS facility. Details of this facility and its uses are discussed in this paper. 4 refs., 8 figs., 5 tabs.

4238 (INIS-mf—11324, pp 128) **Gamma-ray spectroscopy used for tribological diagnostics.** Kosinova, M.; Mladkova, A. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia); CKD Praha (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4239 (INIS-mf—11324, pp 129) **Assessment of thin layer activation and gamma-ray spectroscopy for two-component measurements of wear.** Tendera, P. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4240 (INIS-mf—11328, pp 42) **Fabrication procedures for /sup 57/CoTi and /sup 57/CoZr sources.** Sugimoto, M.; Tuppinger, D.; Vogl, G.; Yoshida, Y.; Buchtela, K.; Grass, F. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik; Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

0703 Isotopic Power Supplies

4241 (INIS-SU—58, pp 3-6) **Some problems and main prospects of developing parametric series of unified radio-isotope thermoelectric generators on the /sup 90/Sr base.** Kodyukov, V.M.; Krasnov, Yu.K.; Makarevich, I.M.; Mostovoj, A.M.; Chechurov, V.A.; Vorob'ev, M.M. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Consideration is being given to studies on unification of radioisotope thermoelectric generators (RITG) on the /sup 90/Sr base, aimed at reducing types of products, creation of unified element base, development of modern base RITG designs. Various ways of creating unified RITG models were discussed. The conducted investigations showed that development of RITG designs of required rated values of electric power was the most effective one for 5-80-100 W power range. As for powers of above 100 W the required power can be provided by a set of several products of lower power. 5 refs.; 1 figs.; 1 tab.

4242 (INIS-SU—58, pp 6-9) **Analysis of physical process inter-relation in radioisotope thermo-mechanical generator.** Kordyukov, V.M.; Krupchatnikov, B.N.; Chechurov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Results of analysing thermal and energy processes in radioisotope thermomechanical generator (RTMG) with Stirling engine, obtained with the use of idealized physical model, are presented. Effect of external load on the formation of object thermal state and its output energy characteristics is considered. The reasons for a

choice of optimal mode of RTMG operation, providing maximal efficiency of energy transformation are given. 3 figs.

08 HYDROGEN

4243 **(BNL—41885) An option for the coal industry in dealing with the carbon dioxide global greenhouse effect.** Steinberg, M. (Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 14p. NTIS, PC A03/MF A01. Order Number DE89002154/JAW.

A new technical option for the coal industry in dealing with the carbon dioxide greenhouse effect has been devised. We have developed a very efficient process called HYDROCARB/sup SM/, which effectively splits coal into carbon and hydrogen. The process has been described in detail. We are suggesting that coal refineries be built based on this technology. The original thrust of this process is to produce a clean, pure carbon fuel from coal for application in both mobile and stationary heat engines. A co-product of the process is a hydrogen-rich gas. If one is concerned about the greenhouse effect, then either all or part of the carbon can be withheld and only the hydrogen is used as fuel. If one desires to attain the ultimate, and eliminate all CO_2 emissions from coal, then all of the carbon can be stored and only the hydrogen used. The option is still open for utilizing the clean carbon, which would be placed in monitored retrievable storage, not unlike the strategic petroleum reserve (SPR). This concept can be valuable to the coal industry in response to the arguments of the anti-coal critics. In this regard, we believe this process is unique; no other process can make this claim. We are convinced that the HYDROCARB Process would be of substantial benefit, economically as well as environmentally, let alone psychologically, to the coal and fossil fuel industry. 12 refs.

0801 Production

4244 **(BNL—41633) Modern and prospective technologies for hydrogen production from fossil fuels.** Steinberg, M.; Cheng, Hsing C. (Brookhaven National Lab., Upton, NY (USA)). May 1988. Contract AC02-76CH00016. 48p. (CONF-880925—2). NTIS, PC A03/MF A01. Order Number DE89001270/JAW.

From Hydrogen today; Moscow, USSR (25 Sep 1988).

A study is presented assessing the technology and economics of hydrogen production by conventional and advanced processes. Six conventional processes are assessed including (1) steam reforming of natural gas, (2) partial oxidation of residual oil, (3) gasification of coal by Texaco process, (4) gasification of coal by Koppers-Totzek process, (5) steam-iron process and (6) water electrolysis. The advanced processes include (1) high temperature electrolysis of steam, (2) coal gasification and electrochemical shift, (3) integrated coal gasification and high temperature electrolysis, (4) thermal cracking of natural gas and (5) the HYDROCARB thermal conversion of coal. By-product hydrogen, thermochemical water splitting and high energy radiation, plasma and solar photovoltaic-water electrolysis production of H_2 are discussed. 23 refs., 11 figs., 8 tabs.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 4170

4245 **(CONF-8703306—1) Techno-economic evaluation of algal biomass energy production and conversion systems: [Final report].** Tsur, Y.; Grimberg, G.; Zilberman, D.; Arad, S. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)). 1987. Contract GI01-86CE31001. 39p. NTIS, PC A03. Order Number DE89002474/JAW.

From US/Israel workshop on large scale fuel production from microalgae; Washington, DC, USA (31 Mar 1987).

In recent years there has been intensive research on the biotechnology of producing fuels from microalgae. The state of the art of this technology, together with an analysis of its economic viability, is found in the Solar Energy Research Institute (SERI) report entitled "Fuels From Microalgae: Technology Status Potential, and Research Requirements." The report comprehensively describes the present status of the biotechnology of producing and processing microalgae into various types of fuels, and evaluates the various cost components associated with implementation of this technology. The present report provides an overview of the important economic aspects of the development of the biotechnology of fuel production from microalgae. The authors focus on the main issues of whether and how to allocate resources for the development of this biotechnology as a viable energy source for the future. Whenever technical details are required, we refer to information contained in a SERI report and to experience accumulated in Israeli industries and research institutions. 17 refs., 3 figs.

4246 **(NP—9770008) Anaerobic treatment of swine manures and of organically contaminated waste waters from animal meal production - a study.** Wolf, E. (Hannover Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft und Abfalltechnik). 1986. 416p. (In German). NTIS (US Sales Only), PC A18/MF A01. Order Number DE89770008/JAW.

Manures from hog growing and highly concentrated predominantly albuminous waste waters from animal meal production, which when combined resemble waste waters from the meat industry, were put to small-scale and semi-industrial tests to analyze the influence of process parameters on the production of manure gases, anaerobic digestion rates and on the process stability of anaerobic digesters. Analyses and analytical results are preceded by a survey which fundamentally and practically summarizes the present knowledge of both the anaerobic treatment of liquid wastes from large-scale animal keeping and of predominantly albuminous waste waters. The summary of fundamentals comprises essential aspects concerning the growth of microorganisms and the conversion processes they are subject to. The four anaerobic digestion phases are described with special regard to the latest knowledge of the interaction between the different bacteria and the growth of the bacteria concerned under different mesophilic conditions. Due to the fact that inhibitors can be detrimental to anaerobic digestion processes fundamental analyses finally refer to the main inhibitors and their effects on methanogenic bacteria.

4247 **Method of inducing surface ensembles on a metal catalyst.** Miller, S.S. (to Dep. of Energy). US Patent Application 6-103,866. 2 Oct 1987. 13p. DE89000193 NTIS, PC A03/MF A01. Order Number DE89000193/JAW.

A method of inducing surface ensembles on a transition metal catalyst used in the conversion of a reactant gas or gas mixture, such as carbon monoxide and hydrogen into hydrocarbons (the Fischer-Tropsch reaction) is disclosed which comprises adding a Lewis base to the syngas ($CO + H_2$) mixture before reaction takes place. The formation of surface ensembles in this manner restricts the number and types of reaction pathways which will be utilized, thus greatly narrowing the product distribution and maximizing the efficiency of the Fischer-Tropsch reaction. Similarly, amines may also be produced by the conversion of reactant gas or gases, such as nitrogen, hydrogen, or hydrocarbon constituents.

0902 Alcohol Fuels

4248 (ACIESP—60-Vol.4, pp 31-37) **Immobilization and continuous culture of cells with radiation polymerized supports for the uses of biomass conversion processes.** Kaetsu, I.; Kumakura, M.; Fujimura, T.; Tamada, M.; Kasai, N. (Kinki Univ., Higashi - Osaka, Osaka (Japan); Japan Atomic Energy Research Inst., Takasaki, Gunma. Takasaki Radiation Chemistry Research Establishment). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

A novel technique for immobilization and biofunctional components such as enzyme, antibody, protein, drug, hormone and organella by means of radiation polymerization was studied and developed. (E.G.).

4249 **(BNL—41701) Conversion of natural gas to methanol.** O'Hare, T.E.; Sapienza, R.S.; Mahajan, D.; Skaperdas, G.T. (Brookhaven National Lab., Upton, NY (USA)). Aug 1988. Contract AC02-76CH00016. 18p. (CONF-8808151—1). NTIS, PC A03/MF A01. Order Number DE89001088/JAW.

From Offshore northern seas conference and exhibition; Stavanger, Norway (23 Aug 1988).

The penetration of natural gas into distant markets can be substantially increased by a new methanol synthesis process under development at the Brookhaven National Laboratory. The new methanol process is made possible by the discovery of a catalyst that drops synthesis temperatures from about 275{degree}F to about 125{degree}C. Furthermore, the new catalyst is a liquid phase system, which permits the synthesis reaction to proceed at fully isothermal conditions, in contrast to the hot spots that prevent currently available pelleted, solid catalysts from operating efficiently. In contrast, the new low temperature liquid catalyst can convert synthesis gas completely to methanol in a single pass through the methanol synthesis reactor. This characteristic leads to a further major improvement in the methanol plant. Atmospheric nitrogen can be tolerated in the synthesis gas, and still the volume of gas fed to the reactor can be smaller than the volume of gas that must be fed to the reactor when accommodating the very low conversions furnished by the best of currently available catalysts.

4250 **(DOE/ER/13625—T2) Model Cu/ZnO catalysts for methanol synthesis: The role of surface structure: Progress report.** Campbell, C.T. (Indiana Univ., Bloomington (USA). Dept. of Chemistry). [1988]. Contract FG02-86ER13625. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003064/JAW.

Catalysts based on CuO/ZnO mixtures are well known for their activity and selectivity in the methanol synthesis reaction ($CO + 2H_2 \rightarrow CH_3OH$). These catalysts are also widely used for water-gas shift ($CO + H_2O$ {l←reversible} $CO_2 + H_2$), which occurs together with methanol synthesis under most conditions. We are attempting to correlate reaction kinetics made at medium-pressure conditions (<10 atm.) on well-defined single-crystal surfaces with: (1) kinetics at similar conditions on high surface area Cu/ZnO catalysts, (2) details of the atomic-level surface structure, and (3) information on adsorption/desorption phenomena available from UHV surface science studies. Model catalysts were constructed based on single crystals where the surface structure is very homogeneous and well characterized using UHV surface analysis. Catalysts include ZnO(0001), Cu(111) and (110), sub-monolayer Cu overlayers on ZnO(000{bar 1}), ZnO/sub x/ overlayers on Cu surfaces, and Cs overlayers on Cu surfaces. To better understand the mechanism of promotion, we have experimentally studied the interactions of CO, CO_2, H_2O and formic acid with the clean and cesium-doped Cu(110) surface, and the coadsorption of H_2O and oxygen on that surface.

4251 **(LA—11396-MS) Methane to methanol: Reactor design and process evaluation.** Tepermeister, I.; Smith, J. (Massachusetts Inst. of Tech., Los Alamos, NM (USA). School of Chemical Engineering Practice-Los Alamos Station). Oct 1988. Contract W-7405-ENG-36. 115p. (MIT-LANL—3). NTIS, PC A06/MF A01. Order Number DE89003381/JAW.

The design of a supersonic nozzle reactor for controlling the partial oxidation of methane to methanol and alternative condenser and gas separation systems were investigated. GENMIX, a simplified fluid dynamics code available at Los Alamos, was modified to simulate mixing and simultaneous chemical reaction in the reaction vessel. Preliminary studies indicate that complete mixing of reactants in a coaxial supersonic expansion nozzle is impossible in the time scale of reaction. A global kinetic model was regressed from computer simulations of the complete reaction mechanism. The global model is felt to be sufficient for preliminary nozzle simulations in a temperature range of 800-1000 K, initial pressure of 60 atm, and initial oxygen concentrations of approximately 33 mol%. Attempts to incorporate global kinetics into the fluid dynamics code were not successful because of code limitations. Two condenser system configurations for the removal of methanol from the process stream were evaluated by simulation with ASPEN PLUS. A two-step series condensation is less energy intensive and has a lower equipment cost than a system consisting of a condenser and distillation column. However, the condenser and distillation system have a higher methanol recovery and product purity. Investigation of possible methods for the separation of methane and carbon monoxide from the process stream revealed that membrane techniques, pressure swing adsorption, and adsorption into propane are feasible alternatives. 27 refs.

0904 Solid Waste And Wood Fuels

4252 **(CONF-880982—1) Emissions resulting from the full-scale cofiring of pelletized refuse-derived fuel and coal.** Ohlsson, O.O.; Daugherty, K.; Venables, B. (Argonne National Lab., IL (USA)). Jun 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01. Order Number DE89000617/JAW.

From 10. annual industrial energy technology conference; Houston, TX, USA (13 Sep 1988).

Full-scale cofiring tests of binder-enhanced pellets of densified, refuse-derived fuel (dRDF) and high-sulfur coal were conducted during June and July of 1987 in Boiler No. 5 at Argonne National Laboratory. These tests were conducted with industry, state, and municipality participation both in critiquing the test plan and in witnessing the actual test runs. Approximately 600 tons of dRDF containing 0%, 4%, or 8% binder were blended with high-sulfur coal at levels of up to 30%, based on the Btu content. This paper describes the dRDF/coal cofiring tests, the emission and ash samples that were taken, the analyses that were conducted on these samples, preliminary test results, and future research plans. 4 refs., 2 figs., 4 tabs.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 4598

1301 Resources And Availability

REFER ALSO TO CITATION(S) 4573

4253 (CANWEC—1988, pp 47-51) **Labrador's power potential.** Collett, T.D. (Newfoundland and Labrador Hydro). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper presents a history of hydroelectric power development in Labrador, and outlines future hydroelectric power potential by drainage region. Annual total hydro potential is ca 54,000 GWh, although not all of this would be economically advantageous to develop. The two most attractive sites, on the Churchill River, have a total potential capacity of 2,316 MW, and the cost of development is estimated at slightly over $3 billion, excluding transmission. 7 figs., 3 tabs.

4254 **(CONF-8604408—1) Step ahead state water requirement forecasting using streamflow observations: Po river watershed, Italy.** Cecconi, G. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Feb 1986. 35p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770077/JAW.

From Symposium on water management for agricultural development; Athens, Greece (7 Apr 1986).

A simple method of forecasting the future monthly degree of satisfaction of an assigned water demand for irrigation is presented. The supply series {Q(t)} is transformed into a state series {S(t)}, each state being defined by the ordinal number j=1,J of the interval containing the value of supply, the intervals being defined by assigned J-1 water demand levels. Small collections of c=1,2,3 successive states are considered to form representational seasonal objects Ok(t)=(S(t-c+1); ...; S(T) which define local terminal month k

shapes within the state series. For every month k, the frequency of occurence of each object in the historical series is used to select dominant objects, which provide the decision criterium for the future state value in time t, when the c-l states S(t-c+l),...,S(t-l) are known. Monthly data from the Po river watershed were used to simulate step ahead state forecasting with various values of J and c. The comparison of actual and forecasted states shows the existence of an optimal value of c for J=2,3,...,5, which maximizes the total number of right state forecasts. The application of the method, for both constant and seasonal water demand levels, to two streamflow series with different characteristics of persistence, shows the convenience of considering objects with c=2 consecutive states. The increase in the number of right state forecasts from the c=l to the c=2 model is about 5% for constant demand and 10%-40% for seasonal demand.

4255 **(NP—9770023) Small-scale hydroelectric power plants in the upper Ems region (FRG). Utilizing an energy source neglected in the past.** Westbeld, H. (Geographische Kommission fuer Westfalen, Muenster (Germany, F.R.)). 1986. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770023/JAW.

The study tries to assess the hydraulic energy potentials made use of in the past as well as the maximum power potential of the Ems river and its tributaries when extended. Estimates assessing the energy potential of shutdown hydroelectric power plants assumed to be suited for reactivation are compared with studies whic since the beginning of the eighties have been supplying data relevant to hills and high mountain regions. The results obtained serve to reveal the difference between plain and high relief power potentials. Objective and easy-to-get-to results are obtained using technical potential calculations which are based on a novel procedure combining conventional methods. (orig./GG) With 1 separate map.

4256 **(NP—9770067) ENEL's (Italian Electricity Board) hydrological/meteorological information network in Alto Piave Basin, Italy.** Tomasino, M.; Stojkovic, P. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Sep 1986. 10p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770067/JAW.

A performance assessment was made of the Italian Electricity Board's (ENEL) hydrological and meteorological information network which makes use of computerized control and data base management systems for meteorological and basin runoff monitoring and forecasting. Sampling techniques, instrumentation, data acquisition, transmission and storage, as well as, probabilistic estimation techniques are described. The network, proven reliable, monitors twenty-two kilometers of river within a basin of 357 square kilometers.

4257 **(NP—9770079) Alto Piave Basin, Italy: various time scale runoff forecasts.** Tomasino, M.; Galeati, G.; Rossi, G. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Sep 1986. 15p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770079/JAW.

This paper describes the mathematical models developed for the study of the Alto Piave Basin runoff. Improved resource management was obtained by the use of these real time forecasting systems which incorporate a remote meteorological/hydrological monitoring system.

1303 Plant Design And Operation

4258 **(CONF-8608190—2) Numerical analysis to identify the unknown load distribution around a power tunnel lining.** Fanelli, M.; Fornero, I.; Giuseppetti, G.; Favro, R.; Mazza', G.; Paolina, R. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Mar 1986. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770069/JAW.

From LRC '86: international symposium on large rock caverns; Helsinki, Finland (27 Aug 1986).

The case history proposed in this paper refers to a hydroelectric plants's power tunnel lining showing cracks along a considerable stretch of its length. In order to evaluate the distribution and the magnitude of the unknown loads that caused the cracks, the problem was analyzed using the finite element method. A linear combination of unitary self-balanced distributed loads (with uniform, linear, quadratic and cubic variations), applied to the external contour line of thetunnel lining, was considered. In the zones in which there were cracks the tensile stresses reached the tensile strength in the concrete used for the construction. Hence, by assuming that the linear combination of the unitary self-balanc ed loads applied to the structures causes the reaching of the tensile limit in the zones actually cracked, a self-balanced load distribution, consistent with the observed cracks, was obtained. The load distribution evaluated by the numerical procedure can prove useful in order to decide the necessary action for the restoration of the tunnel lining integrity.

1305 Economics And Management

REFER ALSO TO CITATION(S) 4548

1306 Environmental Aspects

4259 **(PB—88-241781/XAB) Cultural resource survey of proposed hydroelectric development, Willard Fish Hatchery, Washington. Final report.** Abbott, D.W. (Fish and Wildlife Service, Portland, OR (USA)). 30 Nov 1983. 14p. (DOI/FWS/RI—83/12). NTIS, PC A03/MF A01.

A survey for cultural resources of the proposed Willard Power Project at the Willard Fish Hatchery yielded evidence of aboriginal site utilization. The project area, on the banks of the White Salmon River at an approximate elevation of 1060 feet (353 m), is within the ethnographic territory of the Yakima Indian Nation and is located along a known huckleberry harvesting route.

1307 Power-conversion Systems

4260 **(CONF-8609452—1) Behaviour of a turbine under partial load: a study on a complete model of a hydroelectric power plant.** Angelico, G.; Muciaccia, F.F.; Rossi, G. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Mar 1986. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770060/JAW.

From IAHR symposium; Montreal, Canada (2 Sep 1986).

The paper describes a series of tests performed on a simplified, but complete, medium-head hydraulic power plant equipped with a Francis turbine, and operating at partial load. The aim of the tests was to study the dynamic behaviour of the hydraulic system when excited by the rope induced pulsations. The study also had the goal of the practical definition of the exciting and transfer functions of the hydraulic machine. During the tests, both the penstock natural frequency and the torsional natural frequency of the turbine generator shaft line were modified until values were reached consistent with the rope frequency. The amplitude, as well as, the phase of pressure pulsations in different points of the circuit, and other relevant parameters, were measured.

14 SOLAR ENERGY

1401 Resources And Availability

4261 **(NP—9770090) Measurement and analysis of insolation data on surfaces with different angles of incline.** Gustavson-Seidel, A.; Platzer, W. (Fraunhofer-Institut fuer Solare Energiesysteme (ISE), Freiburg im Breisgau (Germany, F.R.)). [1987]. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770090/JAW.

Detailed knowledge of the insolation conditions for global radiation of the solar spectrum is essential for all applications of solar energy. As it is difficult for the user to carry out appropriate measurements, they were carried out in a specialised institute covering global radiation of surfaces at different angles of incline. The description covers the measuring layout with a pyranometer, a digital voltmeter and computer, and a simple model to represent artificial radiation data. More detailed experiment results on the monthly total radiation, the proportion of direct and diffusion irradiation and

the correlation for the diffusion irradiation (monthly and daily basis), the daily irradiation course and the artificial radiation simulation on surfaces inclined at any desired angle (diagrams) follow. One important result of the experiment was that the conditions on which data is generated must always be checked. (HWJ).

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 4246, 4248, 4294, 4295, 4296, 4297, 4298, 4299, 4300, 4301, 4302, 4303, 4304, 4305, 4306, 4608

4262 **(ADI—195-59) A study of the economic availability of wood residues for fuel in New Brunswick.** (Adi Ltd., Fredericton, New Brunswick (Canada)). Dec 1987. 92p. (MICROLOG—88-04766). New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, N.B., Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report documents an investigation into the production and utilization of wood residues generated in New Brunswick. Detailed data on residue production by primary wood producers and by wood processing plants was assembled and catalogued. Detailed data on the users of such residue, both within the province and in adjacent provinces and the USA, are also included. Other sections of the report deal with the caculation of the heating value of various types of residue fuels and with the development of costs for processing and transportation of wood residues from their source to the point of utilization. Significant findings of the study include the following. About 85% of a total of 1,006,429 bone dry tonnes (BDT) of wood processing residue produced in the province each year is now being used as fuel rather than being incinerated or dumped. Since 1982, annual wood residue consumption has increased by more than 525,000 BDT, with new, large-scale industrial boilers accounting for most of the increase. Any major expansion of wood energy use will require the development of fuel supplies in addition to the small unallocated supply fo wood processing residues. Harvest residues represent a large, almost untapped source of wood fuel, with an estimated total availability of 2,706,340 BDT/y at present harvesting levels. This residue has no potential for higher-value-added usage, and, for this reason, should be developed as the next major source of biomass fuel in New Brunswick. 22 refs., 4 figs., 7 tabs.

4263 **(CFS/VB—BC-X-297) Hog fuel availability in the south coastal region of British Columbia.** Appleby, P.W. (Canadian Forestry Service, Victoria, British Columbia. Pacific Forestry Centre). 1988. 45p. (MICROLOG—88-04705). Canadian Forestry Service. Pacific Forestry Centre, Communications Branch, 506 West Burnside Rd., Victoria, B.C., Canada V8Z 1M5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1985, a total of 3,720,000 gravity packed units (GPUs) of hog fuel were produced in the south coastal region of British Columbia, of which 87% were utilized and 13% were surplus. Four percent of the total fuel produced was exported. Sawmills were the major producers, and pulpmills the major users, of hog fuel. The major portion of the net available surplus is located at shingle and shake mills and sawmills. The Fraser River Delta sub-region is the largest producer of hog fuel, while the Campbell River sub-region is the largest user. The Fraser River North sub-region has the largest net available supply of surplus hog fuel. Of the 3,250,000 units of hog fuel utilized in 1985, 80% was for production of steam and power, 10% was for pulp furnish, 4% was for board furnish, and 6% was used for a diversity of local uses. In 1985, 36% of surplus hog fuel was disposed of by landfill, 42% by incineration and 22% was placed into inventory. 62% of the hog fuel produced was transferred between one mill location and another. Of the 370,000 units of surplus hog fuel, 78% was located on the mainland and 22% on Vancouver Island. 56% of the surplus was cedar, 42% was derived from other conifers, and 2% from cottonwood and alder. 44% of the surplus has been, or could be, hogged by the producer. 56% is produced by mills with no hogging facilities. The net available surplus can vary appreciably from year to year depending on the levels of production and utilization. 1985 was very close to the current norm in terms of total hog fuel production and utilization; production, utilization and surplus were all less in 1985 than in 1977. Changes in hog fuel production and utilization since 1985 could reduce the surplus in 1987 to 230,000 GPUs. 2 refs., 1 fig., 30 tabs.

4264 **(CNBA—1987) Harvesting non-merchantable stands for energy conversion, Shannon, N.B.** (Canada/New Brunswick Agreement on Conservation and Alternative Energy Activities, Fredericton). 1987. 44p. (MICROLOG—88-04694). New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, N.B., Canada E3B 5H1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1987, a non-merchantable stand harvesting project was carried cut on private land in New Brunswick. The objective of the project were to determine the costs of harvesting, processing and delivering chipped non-merchantable wood for conversion into energy; to establish the efficient combination of manual and mechanical forces for economic production; and to determine the resultant economic benefits respecting reforestation of the harvested area. It was determined that wood from non-merchantable stands on private woodlots can be harvested, chipped and hauled 90 km for $25 to $30/green tonne ($38-$46/bone dry tonne). To achieve these costs, an industrial-sized chipping and delivery system must be used. Roads on woodlots must be such that they can accommodate a large chipper and 40-45 ft chip vans. Wood was felled with chain saws and brought full-tree to a well-built road with a cable skidder for this project. Costs were $7.70/green tonne ($11.80/dry tonne). If there is no existing regenerating to be saved, and the organic layer on top of the soil is not too deep, then full tree logging with a cable skidder will prepare the harvested site for planting, thereby avoiding the need for a separate site preparation operation. Potentially productive sites, presently occupied by non-merchantable trees, can be put into the growing of high quality softwoods through harvesting for wood energy. A total of approximately 1500 green tonnes was chipped for this project. 1 fig., 8 tabs.

4265 **(CONF-8804148—3) Linking mechanistic models of tree physiology with models of forest dynamics: Problems of temporal scale.** King, A.W.; Emanuel, W.R.; O'Neill, R.V. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 19p. NTIS, PC A03/MF A01. Order Number DE89002327/JAW.

From Conference on forest growth: process modeling of response to environmental stress; Gulf Shores, AL, USA (19 Apr 1988).

The individual-based forest gap models are a potential resource in the study of forest growth responses to environmental stress acting on physiological processes. This approach is currently limited by the lack of physiological detail in the gap models and by the temporal scales separating tree physiology and the annual tree growth simulated by the gap models. We describe a general procedure that integrates process-based models of tree physiology with forest gap models. The procedure involves (1) a link between a physiological model and a gap model provided by the simulation of annual wood production (AWP), (2) a factorial execution of a physiological model to generate AWP, (3) a response-surface model describing the relationship between AWP and driving variables appropriate to the annual time scale of a gap model, and (4) a revised gap model that includes a rescaled physiological model. The modified gap model can be used to simulate the impact of environmental stress on forest growth and succession. 18 refs., 2 figs.

4266 **(CONF-8804148—4) An evaluation of competition models for investigating tree and stand growth processes.** Doyle, T.W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003617/JAW.

From Conference on forest growth: process modeling of response to environmental stress; Gulf Shores, AL, USA (19 Apr 1988).

Process modeling of forest growth has provided a significant adjunct to field studies by enabling us to test ecological constructs of tree growth and stand-level stresses of both natural and anthro-

pogenic origin. Competition is a major component of these models, though there is little uniformity in the conceptual design and mathematical detail that is employed. The behavior and performance of various competition models were evaluated from both simulation trials and comparative tests using actual field data. Understanding the spatial and temporal aspects of forest competition can only foster our ability to model and assess more accurately the cumulative stresses and interactions of environmental influences.

4267 **(CONF-8810134—2) Seasonal and annual average radon levels in 70 houses.** Dudney, C.S.; Hawthorne, A.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89002233/JAW.

From Symposium on radon and radon reduction technology; Denver, CO, USA (17 Oct 1988).

A year-long, multipollutant, indoor air quality study involving 70 occupied houses in four states was completed in 1987. All of the houses included in the study had a partial or complete basement with a concrete slab floor and block walls. On an approximately quarterly schedule, integrating monitors for short-lived radon progeny, NO2, HCHO, and H2O were exposed for one week in each house on both the basement and main levels. At the beginning of the study, a pair of alpha track detectors were placed both on top of the refrigerator in the kitchen (or some other sampling site on the main floor) and at a sampling site in the basement. One detector at each sampling site was left in place for a year. The other detector at each sampling site was retrieved after about three month's exposure and replaced with another detector for the next quarter. In addition, short-term samples of radon and radon progeny were made at all sampling sites once per quarter. In this paper, comparisons will be made between: (1) seasonal and annual averages, (2) summer and winter averages, and (3) short and long term measurements. 12 refs., 7 figs., 20 tabs.

4268 **(DOE/ER/13506—15) Photochemical solar energy conversion utilizing semiconductors localized in membrane mimetic systems: Comprehensive progress report, April 1, 1986--September 30, 1988.** Fendler, J.H. (Syracuse Univ., NY (USA). Dept. of Chemistry). 1988. Contract FG02-86ER13506. 23p. NTIS, PC A03/MF A01. Order Number DE89003353/JAW.

This paper contain topics on photochemical solar energy conversion in the following areas: preparation and characterization of vesicles and polymerized vesicles; preparation and characterization of bilayer lipid membranes; dispersed colloidal semiconductors; semiconductor-particle-mediated photoconversion in vesicles and polymerized vesicles; and semiconductor-particle-mediated photoconversion in bilayer lipid membranes. 3 figs.

4269 **(DU/B—P-40) Forest biomass and nutrient studies in central Nova Scotia. Part 3. Ambient bulk deposition, throughfall and stemflow in a variety of forest stands.** Prager, U.; Freedman, B. (Dalhousie Univ., Halifax, Nova Scotia (Canada). Dept. of Biology). Apr 1985. 51p. (CE—01994). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Incoming precipitation is a well-recognized and important source of nutrients to terrestrial ecosystems. Although inputs of nutrients to forests via this source occur at fairly low annual rates, over periods of time equivalent to typical rotation lengths (e.g. 50-100 years), total inputs can be substantial. This report presents and discusses data that describe quantities and concentrations of nutrients in ambient precipitation, throughfall, and stemflow. Data were collected in four softwood and four hardwood stands in Nova Scotia. Sampling techniques and chemical analysis procedures are described. Results of measurements are presented in tables indicating the following: average nutrient inputs in bulk-collected precipitation; water and nutrient depositions in total incident precipitation, throughfall, and stemflow, for each stand tested; volume-weighted mean concentrations of various nutrients in the different stands; and stemflow water and nutrient flux, averaged over the growing season for eleven tree species. 16 refs., 19 tabs.

4270 **(ENEA-RT-FARE—87-13) Large-area silicon solar cell spectral response and conversion efficiency: calibration of test apparatus.** Fornarini, L.; Peruzzi, R. (ENEA, Rome (Italy)). Apr 1988. 26p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755369/JAW.

Absolute spectral response and photovoltaic conversion efficiency are two fundamental measurements for solar cell performance rating. Actually, their determination, which is very important for production cost evaluations, is frequently affected by errors arising from the particular experimental set up employed by each laboratory, especially, when cells of a large area (10 x 10 square centimeters) are considered. An independent calibration of these two measurement apparatuses has been performed by ENEA/FARE-FOTO-FISOL and SVIR/ITALSOLAR laboratories in Italy. In this paper, the calibration analyses and results are reported. The absolute calibration our apparatuses have given results in very good agreement with those obtained by qualified international laboratories (SERI, CEC JRC ISPRA). In both cases, the reported measurements are comparable (within 2%) with any available technology.

4271 **(ETSU-B—1165) Study to examine the feasibility of integrating forestry for energy with agriculture on farms in Great Britain.** (UKAEA Harwell Lab. Energy Technology Div.; Reading Univ. (UK). Centre for Agricultural Strategy). 1988. 140p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Energy forestry is here considered as an alternative farm enterprise. Previous studies identified the clear technical and economic potential of energy forestry. The factors likely to affect its practical and commerical implementation, and integration with agriculture, on GB farms are examined.

4272 **(FERIC—F046-17/292E) Design and testing of a prototype rock separator for sortyard debris.** Pottie, M.A.; Sinclair, A.W. (Forest Engineering Research Inst. of Canada, Pointe Claire, Quebec). 1987. 13p. (MICROLOG—88-00715). Forest Engineering Research Institute of Canada, 143 Place Frontenac, Pointe Claire, P.Q., Canada H9R 4Z7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Field tests were conducted in British Columbia on a prototype rock separator system. The rock separator consisted of a rubber belt conveyor built so that belt speed, side tilt, and slope could be readily adjusted. In earlier projects on biomass processing, it was observed that rocks separated from woody material when rubber belt conveyors were operated at nonstandard slopes and belt speeds. These tests were conducted to determine rock-removal efficiency when a flat, rubber belt conveyor was operated with a side tilt and at belt speeds and slopes above those normally recommended for transport of wood waste. The following conclusions were drawn from the field tests. A rubber-belt conveyor, operated with a side tilt and at a speed and slope that are greater than those normally used to transport wood waste can effectively separate rocks greater than 2.5 cm in size from sortyard debris. Rock-separation rates greater than 90% with a wood loss of 29% were achieved during field trials. Increases in belt speed and side-tilt angle were more effective than increases in belt slope in increasing rock-separation rate. Wood loss can probably be reduced by passing the separated rocks and woods chunks over a secondary rock separator. Debris was processed at an average rate of 8.8 tonnes per hour. More productive feeding equipment could increase the production rate. 2 refs., 5 figs., 4 tabs.

4273 **(GB—170) Making fuels from wastes and crops. Biofuels technology in Britain.** (Department of Energy, London (UK)). [1988]. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755534/JAW.

The production and use of biofuels is one of the most promising ways of exploiting renewable energy sources in the United Kingdom. A detailed assessment of the various biofuels technologies recently carried out for the Department of Energy suggests that, at current energy prices, biofuels could make a potential economic contribution to United Kingdom energy supplies of over

four million tonnes of coal equivalent a year (Mtce/yr). And given modest increases in energy prices, the size of the contribution could rise to fifteen Mtce/yr by the year 2025.

4274 **(IEACG—P-292) Economic evaluation of wood chip production activities for P.E.I.** (IEA Consulting Group Ltd., Charlottetown, Prince Edward Island (Canada)). Jun 1985. 222p. (CE—01967). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of this study were to examine the wood fuel supply systems on Prince Edward Island (PEI), to recommend improvements in the existing systems and to analyze the feasibility of establishing a centralized wood chip terminal. Analysis of the projected markets, the major supply systems outside PEI, and the suitable wood chip supply businesses was performed to support these objectives. The wood chip industry in PEI is being supported by governments, and demand for chips is forecast to increase, with considerable acceleration of market growth possible if oil prices rise or if incentives are provided. At present forest growth levels, a total annual sustainable biomass supply of 205,000 oven dry tonnes (odt)/y is forecast; the supply is expected to be sufficient to meet demand. At existing production levels, only one PEI supplier is producing chips at an average price below the expected ceiling price. Significant investment will be required for contractors to produce high volumes efficiently. Chip production equipment most attractive for PEI is listed. Four possible chip production businesses were evaluated to determine estimated prices which yield an attractive return. Small scale production is not expected to produce chips at prices below $63/odt, with $55-61/odt prices expected from medium contractors and $54/odt from large, efficient contractors. The additional risk involved in operating large chip terminals is expected to outweigh the marginal price reduction achieved relative to the large contractor. Integrated sawmills producing chips as a by-product are expected to supply the lowest cost chips, but slab capacity is limited. 57 refs., 35 figs., 71 tabs.

4275 **(JI-MEDD—58) Rotating heat exchanger for liquid manure.** Hauge, P.; Berthelsen, L. (Kongelige Veterinaer- og Landbohoejskole, Tastrup (Denmark). Jordbrugsteknisk Inst.). May 1988. 128p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755045/JAW.

When you treat liquid manure aerobic or anaerobic, the liquid manure has to be heated from the stable temperature to processing temperature, for composting 50 deg. - 60 deg. C and for biogas approx. 35 deg. C. In the manure processing systems known today the treated manure is lead hot into the store tank. This gives a loss of the biologically generated energy for composting heat systems of 25-40%. Because manure is a difficult substance to work with it is necesaary to determine the physical dimensions which influence the convection in the heat exchanger. The viscosity of liquid manure has a decisive importance on the heat transfer. Therefore the variation of the viscosity is determined according to change in temperature, velocity gradient and the total solids percentage. The viscosity depends on both the temperature and the velocity gradient, as it falls when the velocity gradient of the temperature rise. The type of heat exchanger which can solve the problem with heat exchanging for liquid manure is a rotating heat exchanger. With this type of heat exchanger you can increase the velocity gradient and still have a low flow of manure. The main results of the experiments are to be regarded with some reservations, as the conditions under which the experiments were conducted were to som extent difficult. Even with the relative inaccuracy there are some positive tendencies: The heat transfer coefficients for the liquid manure are almost as good as the coefficients for water; the average temperature difference is rather low; the experiences have proven to be a good background for designing a new rotating heat exchanger. 30 refs. (LN).

4276 **(N—88-27621) Solar energy conversion through the interaction of plasmons with tunnel junctions. Part A: Solar cell analysis. Part B: Photoconductor analysis. Final report.** Welsh, P.E.; Schwartz, R.J. (Purdue Univ., Lafayette, IN (USA)). Jul 1988. 145p. (NASA-CR—183044; NAS—1.26:183044; TR-EE—88-37). NTIS, PC A07/MF A01.

A solar cell utilizing guided optical waves and tunnel junctions was analyzed to determine its feasibility. From this analysis, it appears that the limits imposed upon conventional multiple cell systems also limit this solar cell. Due to this limitation, it appears that the relative simplicity of the conventional multiple cell systems over the solar cell make the conventional multiple cell systems the more promising candidate for improvement. It was discovered that some superlattice structures studied could be incorporated into an infrared photodetector. This photoconductor appears to be promising as a high speed, sensitive (high D sup star sub BLIP) detector in the wavelength range from 15 to over 100 micrometers.

4277 **(NP—9770016) Production of fatty alcohols by bioreduction of fatty acids. Final report.** (Henkel K.G.a.A., Duesseldorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). [1988]. 219p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770016/JAW.

The research project assessed the technical and economic potential of bioprocesses for the fat-processing industry. It was found that biochemical reduction of fatty acids to fatty alcohols, either with vegetable or with microbial enzyme systems, cannot compete, for the time being, with the pressure hydrogenation of fatty acid methyl esters or glycerides.

4278 **(PNFI—PI-X-70E/F) [Petawawa National Forestry Institute] bibliography, 1979-1985.** Yapa, A.C.; Mitchell, M.H. (Institut Forestier National de Petawawa, Chalk River, Ontario (Canada)). 1987. 141p. (In English and in French). (MICROLOG—88-00722). Petawawa National Forestry Institute, Technical Information and Distribution Centre, Chalk River, Ont., Canada K0J 1J0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annotated bibliography includes all publications of professionals working out of the Petawawa National Forestry Institute in Ontario, from 1979, when the Institute was formed, to 1985. Contract reports of projects administered by the Institute are also included if these were generally available in the scientific literature. Subjects covered by these publications include such energy-related topics as forest biomass, forest surveys, silviculture and biomass plantations, and environmental studies. Includes indexes.

4279 **(SAND—88-0579C) PC-1D Version 2: Enhanced numerical solar cell modeling.** Basore, P.A.; Rover, D.T.; Smith, A.W. (Sandia National Labs., Albuquerque, NM (USA); Iowa State Univ. of Science and Technology, Ames (USA); Georgia Inst. of Tech., Atlanta (USA)). 1988. Contract AC04-76DP00789. 15p. (CONF-880965—3). NTIS, PC A03/MF A01. Order Number DE89000302/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

PC-1D is a finite-element program for modeling semiconductor devices in one dimension on personal computers. A combination of convenient user interface, rapid convergence, and the ability to address complex issues associated with heavy doping, high-level injection, and transients has led to widespread use of the program by solar cell researchers. Significant improvements have been made to the program, resulting in a new version to be demonstrated at this conference. This paper describes the enhancements and their application to modern crystalline cells, including new provisions for heterostructures, anti-reflection coatings and light trapping, an upgraded user interface, and unattended operation for optimization studies. 10 refs., 6 figs.

4280 **(SAND—88-0628C) The effect of different module configurations on the radiation tolerance of multijunction solar cells.** Gee, J.M.; Curtis, H.B. (Sandia National Labs., Albuquerque, NM (USA); National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1988. Contract AC04-76DP00789. 20p. (CONF-880965—2). NTIS, PC A03/MF A01. Order Number DE89000304/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

The effect of different module configurations on the performance of multijunction (MJ) solar cells in a radiation environment was investigated. Module configuration refers to the electrical circuit in which the subcells of the multijunction cell are wired. Experimental data for AlGaAs, GaAs, InGaAs, and silicon single-junction concentrator cells subjected to 1-MeV electron irradiation was used to calculate the expected performance of AlGaAs/InGaAs, AlGa/silicon, GaAs/InGaAs, and GaAs/silicon MJ concentrator cells. These calculations included independent, series, and voltage-matched configurations. The module configuration was found to have a significant impact on the radiation tolerance characteristics of MJ cells. 6 refs., 11 figs., 2 tabs.

4281 **(SAND—88-0951C) Design and operation of grid-interactive thin-film silicon PV systems.** Marion, B.; Atmaram, G.; Lashway, C.; Strachan, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-880965—24). NTIS, PC A02/MF A01. Order Number DE89001680/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

This paper describes the results from the operation of eleven thin-film amorphous silicon photovoltaic systems at three test facilities: the Florida Solar Energy Center, the New Mexico Solar Energy Institute, and Sandia National Laboratories. Commercially available modules from four U.S. manufacturers are used in these systems, with array sizes from 133--750 watts peak. Measured array efficiencies were from 3.1--4.8%. Except for one manufacturer, array peak power was in agreement with the calculated design ratings. For certain grid-connected systems, non-optimal operation exists because the array peak power voltage is below the lower voltage limit of the power conditioning system. Reliability problems were found in two manufacturers' modules when shorts to ground and terminal corrosion occurred. Array leakage current data is also presented. 7 refs., 7 figs., 7 tabs.

4282 **(SERI/SP—210-3384) SERI preprints for the 20th IEEE photovoltaic specialists conference.** (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 172p. (CONF-880965—). NTIS, PC A08/MF A01. Order Number DE89000809/JAW.

From 20. IEEE photovoltaic specialists conference; Las Vegas, NV, USA (26 Sep 1988).

This document contains preprints prepared by PV scientists at the Solar Energy Research Institute (SERI) and collaborating researchers for the 20th IEEE Photovoltaic Specialists Conference. The conference was held on September 26--30, 1988 in Las Vegas, Nevada. The SERI work described here was funded by the US Department of Energy under Contract No. AC02-83CH10093.

4283 **(SERI/SP—320-3382) Flat-plate solar array project: Government and industry responding to national needs.** Adcock, J.P.; Knecht, R.D. (Solar Energy Research Inst., Golden, CO (USA); Jet Propulsion Lab., Pasadena, CA (USA)). Sep 1988. Contract AC02-83CH10093. 53p. NTIS, PC A04/MF A01. Order Number DE88001185/JAW.

This document recounts the accomplishments of the 11-year Flat-Plate Solar Array Project, which is recognized as one of the most successful and comprehensive technology-transfer efforts ever achieved through government-sponsored research and development. Few federal research projects can claim the degree of industry involvement that was a fundamental aspect of the FSA Project. This philosophy in turn led to an extraordinary transfer of technology to the private sector, and assured that a maximum amount of the taxpayers' dollars were devoted to research of primary importance to the technology's commercialization. 18 refs., 5 tabs.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 4283, 4285, 4313, 4442

4284 **(CONF-861021—3) The photovoltaic plants of Orbetello and Zannone in Italy.** Belli, G.; Iliceto, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Oct 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770058/JAW.

From 7. European photovoltaic solar energy conference; Sevilla, Spain (27 Oct 1986).

The paper illustrates the main technical features of the two stand-alone photovoltaic plants located in the Orbetello lagoon and on the island of Zannone in Italy. These two plants, 1.5 kWp each, were the first to be set up by ENEL (Italian Electricity Board) within the framework of "Case Sparse" ("Isolated dwellings") Project, which is concerned with photovoltaic conversion.

1407 Solar Thermal Power Systems

4285 **(NP—9770005) Dynamic solar energy supply systems. Final report.** (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1987. 539p. (In German). NTIS (US Sales Only), PC A23. Order Number DE89770005/JAW.

This final report is divided into seven chapters: 1. Introduction, 2. Guidelines and definition of concept, 3. Photovoltaic systems, 4. Dynamic solar systems, 5. Comparative evaluation of concepts, 6. Preparing energy and media, 7. Conclusions and recommendations. This study was done on behalf on the West German Ministry of Research and Technology by a working party consisting of universities, industry and the DFVLR. Its aim is to examine the potential of solar thermal energy supply systems compared to photovoltaic ones, with regard to use in permanent space stations in orbits near the earth and in the power range of between 25 . nd 300 kW. The result leads to the conclusion that it is worth while, in preparation for the decision on the development of a second line of space travel energy supply systems, to work intensively on the potential of dynamic solar systems. The conditions for this are given in the recently submitted orientation framework High Technology Space Travel (OHR). (orig./AKF).

1408 Ocean Energy Systems

4286 **(CONF-8810180—1) Fresh water and power from the sea.** Thomas, A.; Hillis, D.L. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000615/JAW.

From OCEANS '88; Baltimore, MD, USA (31 Oct 1988).

An experiment--the Heat and Mass Transfer Scoping Test Apparatus--was built to obtain design data for a larger test that will assess the technical feasibility of the open-cycle OTEC process. (This closed-cycle concept was successfully demonstrated in 1979.) The project is a joint effort between Argonne National Laboratory (ANL) and the Solar Energy Research Institute (SERI). The apparatus was erected at the Natural Energy Laboratory of Hawaii and became operational in the summer of 1987. It is used by both ANL and SERI to conduct open-cycle OTEC experiments. After initial debugging, it produced 350 gallons per hour of potable water having a salinity of 86 ppM, one-fifth that of local tap water available at the test site. 6 refs., 6 figs.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 4310, 4311, 4312, 4642, 4643, 4644, 4645, 4648, 4649, 4655, 4656, 4657, 4943

4287 **(CONF-8606416—) Solar process heat. Critical analysis and future prospects.** Scharmer, K. (ed.). (Gesellschaft fuer Entwicklungstechnologie m.b.H., Aldenhoven (Germany, F.R.)). 1986. 107p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

The meeting on 'solar process heat' was largely dedicated to the following topical papers: collectors and systems (parabolic reflector-type solar collectors, experiences gained in the operation of process heat systems); vacuum collectors and practical examples (designs, uses, economic efficiency, solar thermal processes); technology transfer to the developing countries (demand for process heat generators in Arabia, co-operation between governmental institutions and industry in Turkey, solar energy in Greece). In addition, papers were held on markets and economic efficiency; technological availability and future R and D demands; general and organizational owner requirements. Separate records are available for 9 out of 16 papers. (HWJ).

4288 (CONF-8606416—, pp 10-13) **Experiences gained in the operation of solar process heat plants.** Schreitmueller, K.R. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

The components of solar process heat plants are required to be compatible as well as to suit the respective climatic conditions and energy demands. Diagrams and tables explain the influence of system characteristics, collector characteristics and energy loss analyses on the optimization of plants. Access is given to the structure, operation and performance of a measuring set-up recording collector characteristics, the characteristic's typical features, and the heat loss parameters of pipes and storage systems. After discussing the energy balance of a solar process heat plant equipped with hot-oil storage system (cold store), heat exchanger (freezer) and hot water storage system the paper presents a number of system characteristics of differently located solar plants (climatic zones, industrial planning). (HWJ).

4289 (CONF-8606416—, pp 31-50) **Reflector booster-type evacuated collectors generating process heat.** Scharmer, K. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

Based on a tabular historical survey informing about solar booster uses from Euclid to 1903, details are given on reflector booster-type evacuated collectors (advantages, concentration-dependent efficiency) as well as on a reflector booster-type process steam plant (mirror fixing devices, double-figure sheet metal mirrors, circulating pumps, thermal energy storage systems). Operational results are shown in a table (energy expenses, 30 to 50% overall efficiency). Experimental set-ups for both a refrigerating system (40 square metres collector surface, intermediate storage system, water/air exchanger, photovoltaic generator) and a solar steam generator (121/sup 0/C process steam, autoclave as sterilizer for medical purposes) are under consideration. (HWJ).

4290 (CONF-8606416—, pp 52-59) **Demand for solar process heat systems in the Arab countries.** Jaradat, A.; Ta'ani, R. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

The booming energy demand of most of the Arab countries is due to both an increasing industrialization and the improvement of living standards. Electric power generation, industry and private households are the sectors consuming most of the energy available. As natural gas and petroleum are the only energy sources for most of the Arab countries to rely on efforts have for some time been going into the development of other energy sources. Solar systems for domestic and industrial water heating purposes are successfully being applied in this very sunny region. Industrial energy demands are assumed to be in the order of magnitude of 2.08x10/sup 10/ kWh. Solar energy could replace 20% of the demands. Demonstration programs will verify the technical and economic feasibility of modern state-of-the-art industrial solar process heat systems.

4291 (CONF-8606416—, pp 76-80) **Solar process heat - technology transfer and co-operation with the developing countries.** Fuerkus, J. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

Solar energy utilization creates possibilities of promoting technology transfers and speeding the process of industrialization in the developing countries. UNIDO as the youngest among the special organizations of the UNO is taking active part through realizing adequate technical aids programs and activities. The organization aims at speeding the process of industrialization in the developing countries, increasing the countries' agricultural efficiency and improving their living conditions. Reference is made to the feasible ways and means of deriving profits from solar process heat utilization, the fields of application given preference to (e.g. refrigeration, processing procedures in the food industry), financial assistance, information and analyses, the preparation of projects, and technology transfer programs. (HWJ).

4292 (CONF-8606416—, pp 81-87) **Solar energy utilization in Greece.** Ullerich, D. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

In Greece, thermosyphon-type water heating systems have been standing the test. Within the frame of demonstration programs evacuated collectors have been in use since 1984 (water heating, space heating and air conditioning in schools). Another project intended for partly long-term, partly short-term storage thermosyphons for space and water heating purposes is currently under construction (the Lykovrissi solar village, a Greek/German cooperative program).

4293 **(DTH-LV-MEDD—189) Solar space and water heating plant. Demonstration plant at Ejby.** Andersen, N.B. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Feb 1988. 43p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755043/JAW.

This report concerns the results from the Ejby solar space heating demonstration project. The system is a combined system for space heating and domestic hot water supply: - 17,3 m2 of solar collectors - submerged hot water tank - total water volume; 735 l - drain back collector circuit - separate convector for solar heat. During the period from September 1984 to August 1985 the solar heating system has been monitored using a simple monitoring system. The main result is total annual savings including idle loss: approx. 3000 kWh.

4294 **(MRI/SOL—0207) SOLERAS - Solar Cooling Engineering Field Tests Project: United Technologies Research Center. Design guidelines for solar heating/cooling/power generation systems.** (Midwest Research Inst., Kansas City, MO (USA)). Jan 1987. Contract AC02-83CH10093. 145p. NTIS, PC A07/MF A01. Order Number DE89003228/JAW.

This report documents the methodology, design guidelines and analytical tools for the preliminary technical/economic evaluation of solar heating/cooling/power generation systems. In particular, it provides the theoretical framework, data bases and software tools for: determining the preliminary economic feasibility of solar-powered configurations compared with grid-supplied electric power and/or competing fossil fuels; selecting the optimum system

configuration with respect to solar collector area and "solar-side" thermal storage capacity. Implementation of the methodology described in this report can be facilitated by the use of the accompanying IBM PC-compatible computer program "SOLERAS". This report represents the final task of the multi-year SOLERAS Program -- jointly sponsored by the US Department of Energy and the King Abdulaziz City for Science and Technology -- which involved the development and field-testing of a solar-powered cooling system in Phoenix, AZ. 11 refs., 37 figs.

4295 **(MRI/SOL—0413) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: Solar-collector field experimental tests.** Zimmerman, J.C.; Al-Abbadi, N. (Midwest Research Inst., Kansas City, MO (USA)). Jun 1987. Contract AC02-83CH10093. 273p. NTIS, PC A12/MF A01. Order Number DE89003225/JAW.

The solar-collection field subsystem of the solar-powered desalination pilot project located at Yanbu in the Kingdom of Saudi Arabia has been operated successfully for two years. It has been demonstrated that during a one-year period, the solar-collector field can, on the average, provide about 2500 kWh of thermal energy a day for days with a daily insolation total greater than 4000 Wh/m^2. This is a yearlong solar-collector field average efficiency of 22.5%. In Yanbu, from October 1, 1985, until September 30, 1986, there were only 21 days (5.8%) when the daily direct-normal insolation was less than the mid-60% to 70% range with a peak output of 51 kW per solar collector. It has also been demonstrated that the Power Kinetics, Inc., square-dish solar collector has a problem due to the fixed aperture (outboard focus) that seriously hurts the performance of the solar collector during the summer months at this latitude. A location at latitudes greater than +-35{degree} would see greatly improved daylong summer performance. 4 refs., 3 figs., 1 tab.

4296 **(MRI/SOL—0414) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: Thermal energy storage tests.** (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 209p. NTIS, PC A10/MF A01. Order Number DE89003226/JAW.

The solar-powered water desalination pilot plant at Yanbu in the Kingdom of Saudi Arabia is a unique project in terms of its size, purpose, objectives, and scope. The plant uses a combination of solar thermal energy and fossil-fuel energy to provide the shaft horsepower necessary to operate the indirect heat-transfer freeze desalination process developed and patented by Chicago Bridge and Iron Inc. (CB&I) to produce potable water. The thermal storage acts as a buffer between the energy collection subsystem and the energy delivery subsystem. This report describes the thermal storage subsystem. One of the objectives of the desalination research project is to publish a series of reports on the performance of its various subsystems. The authors of this report do not claim that it is exhaustive and complete in all respects, for more than one reason. Any research activity is like an open-ended problem and during the tenure of its investigation it raises more problems than can be solved. However, the authors believe that the storage system behavior has posed no serious problem and that the report adequately covers all the facets of the investigation. 3 refs., 5 figs., 3 tabs.

4297 **(MRI/SOL—0415) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: CBI Na-Con, Inc. Engineering Test Facility problem assessment and lessons learned.** (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 157p. NTIS, PC A08/MF A01. Order Number DE89003216/JAW.

A Solar Energy Water Desalination Engineering Test Facility has been undergoing operation and testing in Yanbu, Saudi Arabia, as part of of the SOLERAS Program. The facility employs a field of point-focus, distributed receiver, solar thermal collectors operating at 388{degree}C (730{degree}F). Thermal energy is collected using a synthetic heat transfer fluid, stored in dual tank molten salt storage, and utilized on demand to generate steam, which provides both mechanical and thermal energy for refrigeration. The refrigeration drives a unique freeze desalination process in which ice is crystallized from concentrated seawater, pumped as a slurry of ice and brine, rinsed of brine in a countercurrent wash column, and melted to produce fresh water. The report presents an executive summary followed by an overview of the facility design and operation. The plant operation, from start-up in December, 1984 through mid-1986, is then briefly summarized. Key problem areas and areas of concern are identified and discussed; in addition to problems encountered, the discussion details problem causes, problem solutions, and in some cases problem avoidance which was accomplished through preventive measures employed during design and/or operation. The problems are grouped into areas corresponding to the facility's main subsystems: energy collection, energy storage, energy delivery, and desalination. 37 refs., 43 figs., 7 tabs.

4298 **(MRI/SOL—0416) SOLERAS: Solar-Powered Water Desalination Project at Yanbu: Energy delivery system performance.** (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 47p. NTIS, PC A03/MF A01. Order Number DE89003215/JAW.

This report presents an analysis of the performance of the energy delivery subsystem composed of a steam generator and superheater, a steam engine, and steam condensing equipment. When combined, the thermodynamic processes involved in this subsystem form a basic Rankine power cycle. Water is the cycle working fluid. The prime mover is a Skinner RV-1 Unaflow steam engine. The steam condensing equipment includes a condensate pump, boiler feed pump, deaerator, condensate tank, steam condenser, and an absorption refrigeration unit. Control problems, environmental effects, and characterization of the equipment are included in this report. 7 refs., 3 figs., 1 tab.

4299 **(MRI/SOL—0417) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: Indirect freeze desalination system performance.** Zimmerman, J.C.; Al-Abbadi, N. (Midwest Research Inst., Kansas City, MO (USA)). May 1987. Contract AC02-83CH10093. 219p. NTIS, PC A10/MF A01. Order Number DE89003224/JAW.

The desalination subsystem of the solar-powered desalination pilot project located at Yanbu, Saudi Arabia, was operated successfully for two years. Water production rates of 180 m^3/day can be obtained for a period of 24 hours. In addition, once the proper procedures are followed, water production can continue for long periods of time at rates of 135 m^3/day. Electrical energy costs to produce one m^3 of potable water is SR 1.66 in Saudi Arabia and $1.66 to $2.21 in the United States. As with any new process, a number of important details must be learned to obtain the most out of the system. Some of these details are: (1) product water production rate and efficiency are maximized for this system at 10% salinity and ΔTs greater than 3{degree}C, (2) the anhydrous ammonia must be kept clean, (3) the ice in the freezer tubes must be melted without decreasing the salinity of the mixture in the slurry separator, (4) the salinity of the mixture going through each of the freezer tubes must be the same, and (5) the salinity of the slurry must be less than 11%. The authors believe that a subsequent design of an indirect-contact freeze desalination sub-system can be successful. Maintenance of the desalination subsystem has been nominal with only about 6{1/2} person days required per month. Proper operating procedures and some redesign of the desalination subsystem should minimize the required maintenance. 4 refs., 7 figs., 4 tabs.

4300 **(MRI/SOL—0418) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: Forecasting models for operating and maintenance cost of the pilot plant.** Al-Idrisi, M.; Hamad, G. (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 55p. NTIS, PC A04/MF A01. Order Number DE89003223/JAW.

This study was conducted in cooperation with the Department of Industrial Engineering of King Abdulaziz University. The main objective of this study is to meet some of the goals of the Solar Energy Water Desalination Plant (SEWDP) plan in the area of economic evaluation. The first part of this project focused on describing the existing trend in the operation and maintenance (O&M) cost for the SOLERAS Solar Energy Water Desalination Plant in Yanbu. The second part used the information obtained on existing trends to find suitable forecasting models. These models, which are found here, are sensitive to changes in costs trends. Nevertheless, the study presented here has established the foundation for (O&M)

costs estimating in the plant. The methodologies used in this study should continue as more data on operation and maintenance costs become available, because, in the long run, the trend in costs will help determine where cost effectiveness might be improved. 7 refs., 24 figs., 15 tabs.

4301 **(MRI/SOL—1605) SOLERAS - Analysis of photovoltaic concentrator module failures and repair methods.** Huraib, F.S.; Imamura, M.S.; Salim, A.A.; Rao, N.R. (Midwest Research Inst., Kansas City, MO (USA)). Jun 1987. Contract AC02-83CH10093. 143p. NTIS, PC A07. Order Number DE89003222/JAW.

This report presents the results of the failure analysis, performed from early 1984 through September 1986 on the open-circuited modules, and the assessment of repairing these modules on site at the Solar Village. 16 refs., 26 figs., 19 tabs.

4302 **(MRI/SOL—2001) SOLERAS - Solar-Powered Water Desalination Project at Yanbu: PKI collectors performance.** Hamad, G. (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 304p. NTIS, PC A14/MF A01. Order Number DE89003221/JAW.

The seawater desalination pilot plant at Yanbu in Saudi Arabia is a unique experiment in which an indirect bulk freeze desalination process is integrated with a stand-alone solar cogeneration power plant. Thermal energy is stored in molten salt and is converted into shaft power required for primary refrigeration by a conventional steam engine. An absorption refrigeration unit is thermally driven by the exhaust steam of the engine to produce additional refrigeration. Crystallization of water molecules from the brine into essentially pure water ice is accomplished by the freeze desalination process, which employs indirect heat transfer technique. Solar energy concentrated by the dish collector is transferred to a silicone polymer low-viscosity liquid circulated through the receiver, which is a monotube cavity mounted at the concentrator focal area in a stainless steel encased housing. A flux trap mounted at the mouth of the cavity receiver deflects stray radiation into the cavity. This document concerns itself with the solar collector and the solar collector field subsystem and presents the results of scientific investigations during the past 18 months since the plant installation. 13 refs., 206 figs.

4303 **(MRI/SOL—2301) SOLERAS - Summary technical report on SOLERAS Urban Solar Applications Projects.** Beba, A.; Adcock, J.P. (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 86p. NTIS, PC A05/MF A01. Order Number DE89003220/JAW.

Work performed under SOLERAS, a joint US-Saudi Arabian solar energy research and development program, helped advance the state-of-the- art of solar energy to its current levels. The technological progress achieved by SOLERAS improved solar energy systems for urban, rural, and industrial applications. In addition, the insights gained by designing systems for multicultural applications will hasten the introduction of those technologies into different regions of the world. This document reports the advances in solar cooling technologies made by SOLERAS. These solar cooling systems are particularly well adapted for the developing countries, where a lack of traditional energy infrastructures renders conventional cooling systems impractical for widespread use. The cooling technologies reported here rely on a domestic resource, solar energy, that is well dispersed throughout most of these countries. There is no need to construct vast distribution networks to realize its potential and, perhaps more importantly, the foreign debt burdens are not aggravated by added energy importation requirements. 30 refs., 14 figs., 5 tabs.

4304 **(MRI/SOL—2401) SOLERAS: Rural/agricultural project technical overview.** Huraib, F.S.; Adcock, J.P.; Knect, R.D. (Midwest Research Inst., Kansas City, MO (USA)). Apr 1987. Contract AC02-83CH10093. 161p. NTIS, PC A08/MF A01. Order Number DE89003219/JAW.

The objective of the Rural and Agricultural Solar Applications Projects is to enhance the quality of rural life in hot, arid climates by providing systems that use renewable or regenerable energy sources for domestic or communal, agricultural, and local industrial applications. These systems must provide domestic services such as hot water, heat for cooking, and electric power for lighting, communications, and refrigeration. In addition, agricultural applications such as water desalination, irrigation pumping, and heat and electricity for crop or food processing and local industrial functions, can become the basis for improving the villagers' standard of living. 29 refs., 82 figs., 23 tabs.

4305 **(MRI/SOL—2501) SOLERAS - Summary technical report on SOLERAS Industrial Solar Thermal Applications Project.** Zimmerman, J.C. (Midwest Research Inst., Kansas City, MO (USA)). Oct 1987. Contract AC02-83CH10093. 30p. NTIS, PC A03/MF A01. Order Number DE89003218/JAW.

This document reports the advances in solar industrial applications made by SOLERAS, a joint United States-Saudi Arabian solar energy research and development program. The industrial application chosen was the freeze desalination of seawater powered by mid-temperature (385{degree}C) solar collectors. This innovative process will compete with other downscaled desalination processes for small communities in developing countries. Using solar energy to power this installation demonstrates the ability of solar energy to fuel any industrial application that requires mid-temperature energy. 13 refs., 11 figs.

4306 **(MRI/SOL—2901) SOLERAS - Saudi Arabian-United States Program for cooperation in the field of solar energy: Executive summary SOLERAS Program overview.** Williamson, J.S.; Key, W.P. (Midwest Research Inst., Kansas City, MO (USA)). Mar 1987. Contract AC02-83CH10093. 41p. NTIS, PC A03/MF A01. Order Number DE89003217/JAW.

The SOLERAS Program was a unique bilateral, international, cooperative research effort. The intent of SOLERAS was to utilize the technical and financial resources of each country to advance the development of solar energy through cooperative research projects. The Program involved research and applications in most of the major renewable technologies during its nine-year life, and its participants include some of the most accomplished individuals, corporations, universities, and laboratories in solar energy research. The Program benefited enormously from the professional and personal commitment of these participants. SOLERAS accomplished several major research projects, completed resource assessment activities, and sponsored numerous technology workshops, short courses, and technical reports. This Executive Summary report provides only a limited overview of the activities and major accomplishments. Detailed project activities and experiences are documented in numerous SOLERAS reports describing system design, operations, and evaluations. These reports are available in the United States through the National Technical Information Center. In Saudi Arabia, these reports are available through the King Abdul Aziz City for Science and Technology. 19 figs., 4 tabs.

4307 **(NRC/BR—77) Solar heating developments in Canada and abroad.** Sasaki, J.R. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). [1977]. 8p. (CE—01989). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The paper reviews ongoing Canadian activities related to utilization of solar energy for heating buildings. These include the formation of the Solar Energy Society fo Canada; a study on the feasibility of solar heating in Canada conducted by the University of Waterloo; and the intitiation of six solar-heating demonstration projects under the Canadian Urban Demonstration Program. New activities reviewed are the $550,000 Federal funding program for encouraging solar heating heating in buildings; the forthcoming solar-heated Senior Citizen Home sponsored by the Province of Ontario; and the ongoing construction of privately-funded solar-heated homes. International activity on solar energy utilization is reviewed for comparison with the Canadian level of effort. 6 refs.

4308 **(NRC/BR—102F) Solar heating - the state of the art.** Quirouette, R.L. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Oct 1975. 9p. (In French). (CE—01987). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A basic introduction to solar heating in Canada is presented, starting from a description of solar radiation and insolation, and proceeding to the basics of solar energy conversion and applications to heating. Solar collectors and solar heat storage methods are outlined. Solar heat applications are illustrated by describing a number of projects constructed in the USA and Canada. Solar heating research programs in various countries are briefly examined, and the future possibilities of solar energy mentioned. 9 figs.

4309 **(NRC/BR—7702) A listing of some of the information available on solar heating in Canada.** (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). Feb 1977. 10p. (CE—01988). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This bibliography/directory contains a list of recent popular and semi-technical articles on solar heatiing, selected Canadian and US technical references on solar heating (including information on availability), a list of Canadian solar hardware manufacturers and distributors and Canadian solar heating consultants, and a list of contacts (demonstration projects, researchers).

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 4287, 4289, 4290, 4294, 4295, 4296, 4297, 4298, 4299, 4300, 4301, 4302, 4303, 4304, 4305, 4306

4310 (CONF-8606416—, pp 14-20) **Parabolic reflector-type solar collectors.** Melchior, E. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

Introductory remarks on HELIOMAN-M-480 collector systems are followed by a comprehensive table showing characteristic values which facilitate access to the technical features of the mirror (self-supporting glass, silver-coated back, 0.94 reflection coefficient), absorber (black chrome-coated steel pipes), collector/pipe connections, and the horizontally aligned single-axle mirror tracker. Data and facts on the system as a whole (solar farm concept) are followed by an account of experiences gained in the operation of three solar process heat plants (Italy, United Arab Emirates, Portugal). Reference is made to the maximum outputs, the cleaning of mirrors, automation, the avoidance of superheating, the availability of plants, exchange of parts and components, maintenance intervals, training of maintenance staff, and the improvement of collector modules. The paper concludes with remarks on the present uses and state of development of parabolic reflector-type solar collectors. (HWJ).

4311 (CONF-8606416—, pp 21-25) **Possibilities for solar process heat generation in Holland.** Hirs, G. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

In the Netherlands, the food, meet and dairy industries (heat demand 120/sup 0/C) can derive the most from solar process heat uses. Several low-temperature heating systems and systems studies are currently under consideration. Access is given to industrial solar uses. The attractiveness of low-temperature uses remains to be verified by practical experiences. Reference is made to the necessity of energy storage systems as well as to the fact that computer simulation programs for large solar systems are not available in the Netherlands. Within the 90/sup 0/C temperature range flat plate collectors with selective coating and reduced convection losses are to be preferred in vacuum collectors. (HWJ).

4312 (CONF-8606416—, pp 26-29) **CORTEC evacuated collector.** Courtier, A. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

For 13 years now, evacuated collectors of the CORTEC type have been verifying their excellent properties in different fields of application. Their use turns out to be successful wherever industrial plants (e.g. meet industry, grape juice plants, heat distribution networks) are in need of 75/sup 0/C min. process water. With a photograph added of each of them, a tabular survey compiles some of the operational features of three systems. The data given refer to the collector surfaces (292/406/1000 m/sup 2/), water temperatures (75/75/90/sup 0/C), and to the overall systems efficiencies (20/25/32%). Collector field efficiencies are assumed to be improvable through further investigation both into heat transfer problems and individual energy losses. (HWJ).

4313 **(DOE/EIA—0174(87)) Solar collector manufacturing activity 1987.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 18 Nov 1988. 49p. NTIS, PC A03/MF A01 - GPO. Order Number DE89003383/JAW.

Shipments of solar thermal collectors in 1987 were reported by 58 firms, totaling 4.1 million square feet of collectors. Of these, approximately 691,000 square feet of collectors were imported and approximately 182,000 square feet were exported for use in other countries. Low-temperature collectors comprised more than three-quarters of total shipments, with the remaining shipments comprising medium-temperature, special, and "other" solar thermal collector types. Solar collector shipments (including exports and imports) declined from an average of 18 million square feet between 1980 and 1984 to 5 million square feet in both 1986 and 1987. The decline began with the expiration of the 40-percent residential energy tax credit and the 15-percent business energy tax credit at the end of 1985. 21 tabs.

1420 Heat Storage

REFER ALSO TO CITATION(S) 4294, 4295, 4296, 4297, 4298, 4299, 4300, 4301, 4302, 4303, 4304, 4305, 4306

15 GEOTHERMAL ENERGY

4314 **(NP—9770080) Geotehrmal electricity production in Italy.** Palmerini, C.G. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Apr 1986. 15p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770080/JAW.

ENEL's (Italian Electricity Board) policies with regard to the continued development of geothermal energy in Italy are discussed. As reference, descriptions are provided of planned and operating plants, with special emphasis given to activities in the Larderello, Latera and Cesano fields. Aspects related to state-of-the-art technology, exploratory drilling, investments, financing and environmental protection are presented. ENEL's research programs are also outlined.

4315 (SEGJ—8801, pp 243-248) **Study on estimation of formation temperature from short-period logging data.** Takasugi, Shinji; Chiba, Masahiro; Muramatsu, Shigeki; Shinohara, Nobuo. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan; New Energy Development Organization, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Based on the project "Development of the binary cycle power generation plant" promoted by NEDO, the estimation of formation temperature from shorter-period logging data after well drilling was researched. The estimated temperature by a Hornorplot method (standing time: about 120 hours) was compared with that by a curve-fitting method(standing time: about 8 hours) based

on a mathematical thermal equilibrium model, furthermore influence factors on the accuracy of the later method were investigated. As a result, differences between temperatures of both methods estimated from logging data on 13 wells in 8 geothermal fields of Japan were less than 10°C, thus the later method was shown to be relatively reliable besides simple. However, in terms of estimation parameters, the use of field-measured data was essential for thermal conductivity of rock, and problems of the radius of influence area were remained for future studies. For more improvement of estimation accuracy, that of measurement accuracy of logging tool such as logging more data is also neccesary. (11 figs, 2 tabs, 5 refs)

4316 (SEGJ—8801, pp 249-254) **Lost circulation detector (PTS logging tool) test under the drilling and condition.** Okabe, Takashi; Takasugi, Shinji; Hyodo, Masami; Muramatsu, Shigeki; Shinohara, Nobuo. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan; New Energy Development Organization, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Based on the project "Development of the binary cycle power generation plant" promoted by NEDO, the condition, location and scale of lost circulation were researched using a improved lost circulation detector on BS-6 well under drilling in Oita Prefecture. A logging tool made by Scientific Drilling International(SDI) Co., USA was used. To decrease liquid friction a spinner was spaced 1.2m apart from the main logging tool with a spacer bar, and to prevent to clog with mud a impeller of 4.5 inches in diameter was also used by removal of a guide case. As a result, the spinner was most effective to specify the position of lost circulation in mud, and one position not found out during drilling was specified. However, the improvement of spinner resolution at lower speed rotation and the miniaturization of the spacer bar or logging tool itself for decrease of liquid friction are remained for future studies. (6 figs, 2 tabs, 3 photos, 3 refs)

1501 Resource Status And Assessment

4317 **(EMR/EP—1981) The Geothermal Energy Programme. A review.** Jessop, A.M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Earth Physics Branch). [1981]. 22p. (CE—02006). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Canadian Geothermal Energy Program has always been regarded as one of resource identification and assessment, rather than one of resource conversion and utilization technology. Consequently, this program has been made up of earth sciences and mineral exploration components. Nevertheless, a regard for the available technology and markets for geothermal energy has played a major part in determining the geographical areas of research. Most of the work in the program has been done under contract, and from 1976 to 1981 there were three overall projects: delineation of major geothermal anomalies; identification and assessment of geothermal resources for possible exploitation; and investigating the low-grade geothermal energy potential from sedimentary basins. For 1981-82 the first two of those projects were revised to: identification and assessment of geothermal resources in non-volcanic terrain, and identification and assessment of geothermal systems associated with recent volcanic activity. A new project was added, exploring the geothermal resources of the Atlantic region. Specific projects highlighted in this report are the discovery of a possible geothermal steam reservoir under Mt. Meager in British Columbia, and investigation of the feasibility of using low-grade hot water from the sedimentary basin under Regina for space heating. 4 tabs.

4318 (SEGJ—8801, pp 352-353) **Gravity survey crossing the median tectonic line near Kokawa in Wakayama prefecture, Japan.** Sato, Tatsuya; Kitsunezaki, Choro; Iwasaki, Yoshinori. (Akita Univ., Mining College, Akita, Japan; Osaka Soil Lab., Osaka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

As for detailed structures of the Median Tectonic Line (MTL) in Wakayama Prefecture, the survey by a seismic reflection method had been carried out to reveal recent tectonic movement as active fault, and it had been found out that MTL has the nature of low angle thrust where thick Recent sediments are overlaid with Mesozoic sandstones. In order to confirm the above result by the gravity survey in the same area and to evaluate its potential, the survey was conducted using a survey line of about 20km in length crossing MTL and two parallel auxiliary short survey lines. Geological structures were analyzed mainly by a two-dimentional model with measured Bouguer anomaly data, and changes of gravity anomaly value depending on changes of thrust angle were also revealed. Consequently the result of the seismic survey was confirmed, and as the gravity survey was planned carefully and interpreted exactly, the survey was expected to assist the expensive seismic survey and to contribute the clarification of fault forms. (2 figs, 1 ref)

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 4143

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 4143, 4318, 5264, 5313

4319 **(NP—9770028) GB Bruchsal 2 geothermal well for re-injection of hot water with high salinity. Final report.** Fritz, J.; Bertleff, B.; Hedin, K.; Joachim, J.; Kaess, W.; Koziorowski, G.; Leiber, J.; Maus, H.; Schweizer, R.; Stober, I. (Stadtwerke Bruchsal G.m.b.H. (Germany, F.R.); Geologisches Landesamt Baden-Wuerttemberg, Freiburg (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Aug 1986. 169p. (In German). NTIS (US Sales Only), PC A08. Order Number DE89770028/JAW.

After site preparation and conductor setting, the Bruchsal 2 geothermal well was sunk to a depth of 2542.00 m within a period of 74 days, from December 15, 1984 to February 26, 1985. The total drilling error was 143.8 m at an azimuthal angle of 62.5/sup 0/, a loss in depth of 10.10 m, and a maximum angle of inclination of 13/sup 0/. The hot water deposits in the Middle and Lower Triassic and the Permian strata were tapped at a depth of 2280.60 to 2537.00 m via a 5" slotted liner. 11 pumping tests with different pumping rates were carried out in order to determine the deposit capacity. The Bruchsal 2 well was completed by installing a 10 3/4" protective tube with internal lining from ground level to a depth of 154.13 m and by mounting the well head. The basic temperature of the well is 128.4/sup 0/C at a transmissivity of 10/sup -3/ m/sup 2//s. The well was found to have a hydraulic connection with the GB Bruchsal 1 geothermal well. The idle level is 60 m below ground water level.

4320 (SEGJ—8801, pp 62-66) **Shear-wave splitting analysis in tri-axial downhole AE measurement.** Matsumoto, Norio; Sato, Motoyuki; Niitsuma, Hiroaki; Nakatsuka, Katsuto. (Tohoku Univ., Faculty of Engineering, Sendai, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the possibility whether the seismic S wave splitting analysis, which is used for multi-point exploration to analyze the underground fractures in a propagation medium, can be applied to in-well tri-axial AE measurement or not. Based on the result, a new tri-axial AE analysis for estimating geologic fractures was proposed. This analytical technique was applied to the analysis of AE data obtained in the Kakkonda geothermal field. The estimation results of the existing geologic fractures in the field were described. By the S wave splitting analytical method, the deflection direction of the S wave which propagates fast was observed to acquired information on the orientation direction of geo-

logic fractures. The density of fractures can be given by using the distance which AE propagates through a medium containing geologic fractures, and the difference between the arrival times of fast and slow S waves. The acoustic source depth at which the difference between the S wave arrival times was zero was 570 m, 800 m, and 950 m. These depths indicate the positions of geothermal resources. (6 figs, 4 refs)

4321 (SEGJ—8801, pp 82-84) **Fractures detected by ultrasonic borehole televiewer in Hijiori SKG-2 and HDR-1 wells and relation to hydraulic fracturing.** Ito, Hisao; Kikuchi, Tsuneo; Nakao, Shinsuke; Matsunaga, Isao. (Geological Survey of Japan, Ibaraki, Japan; National Research Inst. for Pollution and Resources, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Relation between hydraulic and natural fracturing was examined, based on the observational results by a borehole televiewer (BHTB) in Hijiori SKG-2, HDR-1 wells for investigation of a hot-dry-rock system. For the SKG-2 well, the BHTV observation and the flow rate logging before the hydraulic fracturing revealed that two fractures immediately below the casing shoe were formed before the hydraulic fracturing. It is suggested that the hydraulic fracturing in 1986 might cause a vertical fracture along the well axis, or the existing fracture might be opened again. For the HDR-1 well, the BHTV observation was conducted in the depth range of 1506 m - 1802 m. The flow path 1743 m deep was along a prolonged line from the fracture immediately below the casing, and fractures of which the directions were the same, above and below the flow path existed. This suggests that the flow path was completed through the existing fractures. (3 figs, 2 refs)

4322 (SEGJ—8801, pp 85-87) **Determination of three-dimensional velocity structure of Hijiori geothermal field, Yamagata Pref. by using shooting data.** Nakao, Shinsuke; Kuwahara, Yasto; Sugihara, Mitsuhiko; Tosha, Toshiyuki; Ito, Hisao. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

In high-temperature Rocks Power Generation Techniques Development Project in the Hijiori geothermal field (Japan), shooting for AE signal calibration was conducted in 1987. Based on the observatory data, the three-dimensional velocity structure in the field was determined. The data used for the determination were obtained with P waves in propagation. For determination of a three dimensional velocity structure, theoretical and observatory equations were set up, based on the original velocity structure model. The deviations were determined. This procedure was repeated till the deviation was not improved in order to determine the velocity structure. The obtained velocity structure has the following features: as a whole, the structure is gently inclined in the north-east; and a sharp velocity gradient exists immediately on the east side of SKG-2. These features agree with the gravity data and the well logging data for the field. Particularly, the sharp velocity gradient coincides with the normal faults in position found by the well logging data, etc. (6 figs, 3 refs)

4323 (SEGJ—8801, pp 255-260) **Pressure response of capillaly tube type pressure monitoring system.** Osato, Kazumi; Takasugi, Shinji; Okabe, Takashi; Muramatsu, Shigeki. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Since a capillaly tube system used for long-term down hole pressure monitoring produced responce errors in the tube and was required to correct pressure for rapid pressure transition, the experiment for the pressure response in the tube was carried out in case of pressure build-up. As a result, the pressure response with no temperature change was expressed by a empirical formula with parameters consisting of the length and bore of the tube, initial pressure and pressure change, and the agreement between measured and calculated data was obtained sufficiently. The delay time of the pressure response in a narrow tube of 1/8 inch in outside diameter reached four times that of 1/4 inch. In this experiment with no consideration of transient, correction values of the pressure response before reaching to stable pressure were obtained only for momentary pressure change. The research of a relation between correction and tube diameter in case of pressure draw-down is remained for future studies. (12 figs, 3 tabs, 1 ref)

4324 (SEGJ—8801, pp 267-268) **Physical properties of drilling cores of HY-4 well in Hatchobaru area.** Noritomi, Kazuo; Ushijima, Keisuke; Yamashita, Akio; Nakajima, Hidefumi. (Kyushu Univ., Faculty of Engineering, Fukuoka, Japan; Ministry of International Trade and Industry). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The physical properties of drilling cores of HT-4 well in Hatchobaru area were measured. This well was developed in 1979 with drilling length of 1510.7 m. One hundred eighteen samples were taken at intervals of 5 to 20 m. The formation of depth of 1127 m or more are Usa formation consists of diabase andesite lava and homogeneous tuff conglomerate, depth of 209.6 to 1127 m are formed by Hohi volcanic rocks consist of mainly amphibole andesite and homogeneous tuff conglomerate, diabase andesite. Ground surface (1147.0 m above sea level) to 209.6 m are formed mainly by amphibole andesite. In the lower formation (depth of 1153 to 1243 m) of Hohi volcanic rocks which show scarcely metamorphism and Usa formation with depth of 1363 to 1446 m, the Archie's expression is applicable approximately about the resistivity and effective porosity. The lower formation of Hohi volcanic rocks is impermeability formation with minute rocks. The geothermal reservoir rock exists with a function of like a cover around geologic faults which appeared between the lower formation of Hohi volcanic rocks and Usa formation. (1 fig)

4325 (SEGJ—8801, pp 293-298) **Development of a new MT system using the commercial power line as a source (2).** Tsubota, Koji; Noritake, Kazumitsu; Sakuma, Hideki; Saito, Akira; Shiga, Nobuhiko. (Power Reactor and Nuclear fuel Development Corp., Tokyo, Japan; Mitsui Mineral Development Engineering Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The results of demonstration tests for a newly developed PLMT (power line magneto-telluric) method were reported. The tests were carried out in Fukushima Prefecture(commercial frequency: 50Hz) and Kagoshima Prefecture(60Hz), and PLMT data were compared with other data obtained by ELFMT or CSAMT method. PLMT equipment was small, light weight and simple, whereby it was very easy to measure even in a area onto which could not drive a car and measuring time was only several minutes for every point, and PLMT data were also well matched with data of other geophysical methods. It was necessary to measure 100m or more apart from a power line or telephone line, and if the mean direction of a potential electrode was impossible to be determined in case of plural power lines, it was preferred to measure in various directions while rotating a direction by 45°. Possibility of vertical prospecting as far as several hundred meters underground was also shown with analysis by the inversion program of MT method. (9 figs, 4 refs)

4326 (SEGJ—8801, pp 354-356) **Gravimetric terrain correction of extreme-far region and its truncation error.** Komazawa, Masao. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Gravimetric terrain correction including submarine terrain was calculated over the whole world, whereby its truncation errors of terrain correction were investigated. A terrain model for correction was formed by assuming a annular spherical crust, and the terrain data file of the whole world made by NOAA was used. The range of the extreme-far region for terrain correction was defined

as the whole world except the region within an usual correction distance (truncation distance) of 60km, and as an example, correction values of the finite region around Japan were calculated. As a result, truncation errors of terrain correction values had a pattern depending strongly a terrain. The error was about 100 mgal on the continental side in the northwest, whereas about 200 mgal on the ocean side beyond Japan trench in the southeast with a large difference of 100 mgal. Consequently, as a density heterogeneity in mantle or the like were analyzed conventionally based on a Bouguer anomaly chart, it was pointed out to exist the risk of deriving smaller analysis values on the ocean side. (2 figs, 3 refs)

4327 (SEGJ—8801, pp 357-362) **Approach to the computation of terrain correction of gravity using microcomputer.** Nishitani, Tadashi; Kikuchi, Shin'ichi; Nagasaki, Yasuhiko. (Akita Univ., Mining College, Akita, Japan; Iwate Prefectural Education Center, Iwate, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Terrain correction computation system given priority on the reduction of operation time and the compatibillity of data and programs using 16 bits microcomputer was introduced. Height data were stored on a floppy disk for every terrain map of 1 to 200,000, and operation time were reduced by use of binary format data. For approximation, a rectangular prism method was changed to a less precise line mass one at 750m in distance, however, differences between both correction data were less than several microgal. A correction region was defined as a square surrounded by four sides 80km apart from a station. In order to compare with large scale computer systems, the correction data were compared with those obtained by the similar system of Nagoya University, and a satisfactory agreement between both data was confirmed. Correction data calculated on the sea area were compared with theoretical data to check the reliability of the system, and a good agreement between both data was obtained. As a result, it was concluded that this system was possible to calculate easily and precisely the terrain correction of gravity over the length and breadth of Japan. (9 figs, 14 refs)

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 4319, 4323, 4881

16 TIDAL AND WAVE POWER

1607 Tidal Power Plants

4328 **(ETSU-STP—4052) Sand embankments and diaphragm walling for tidal power barrage construction.** (UKAEA Harwell Lab. Energy Technology Div.; Rendel Palmer and Tritton, London (UK)). 1988. 131p. British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A study to develop feasible and economic methods of constructing and protecting temporary sand embankments in deep tidal water and of constructing diaphragm wall cofferdams through the sand, to allow in situ construction of tidal barrages is outlined. The results based on design parameters and geometry typical of proposed barrage sites in the UK are presented. Three "typical" sites have been selected for outline design representing large, intermediate and small estuaries with appropriate widths, depths, tidal ranges and wave climates. A range of methods of forming and retaining sand embankments is briefly described and includes sacrificial beaches, rockfill bunds, precast concrete revetments, geotextile containers, caissons (redundant vessels), hydrostatic containment and soil freezing. Three methods of constructing the embankments are considered to be most suitable because of the temporary nature of the embankment.

17 WIND ENERGY

4329 **(CANWEA—8801) Proceedings of the Third Annual National Conference of the Canadian Wind Energy Association (CANWEA).** Lacey, V.P. (ed.). (Canadian Wind Energy Association, Ottawa, Ontario). Jan 1988. 376p. (CONF-8709374—; CE—02009). Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN.

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A conference was held on various aspects of wind energy in Canda. Papers were presented in the areas of wind resource assessment, wind turbine generation projects, small wind energy conversion systems, turbine design, wind turbine inventory, wind test sites, water pumping, energy policy, research programs and demonstration projects, commercialization, financial aspects, and interconnection with electric utilities. Separate abstracts have been prepared for 25 papers from this conference.

4330 **(CONF-861062—15) Wind power: current prospects.** Milborrow, D.J.; Invernizzi, A.; Grastrup, H.; Overdijk, J. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Nov 1986. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770059/JAW.

From European wind energy conference; Rome, Italy (7 Oct 1986).

In Western Europe, the potential of wind energy as a source of electricity, suitable for electric utilities, is being carefully evaluated. The utilities concerned base their assessments on similar criteria - the need for diversity in power supplies, the magnitude of the wind power resource, the costs of wind energy - relative to those of other sources - and the feasibility of installing large numbers of wind turbines. The utilities all recognise that wind energy technology has advanced to the point where they wish to gain operating experience with wind turbines. In addition, they are carrying out supporting research and are co-operating closely with the appropiate governmental agencies who are responsible for the development of the technology. In Denmark and the Netherlands, targets for wind power capacity have been set. However, in Italy and the UK, the results from step-by-step programmes will be used to shape future programmes. In the longer term, the development of wind energy will be influenced by such factors as economic growth, fossil fuel prices and the evolution of wind energy technology.

4331 **(DOE/CH/10093—26) Wind energy systems: Program summary for fiscal years 1986 and 1987.** (Solar Energy Research Inst., Golden, CO (USA)). Oct 1988. Contract AC02-83CH10093. 103p. NTIS, PC A06/MF A01 - OSTI. Order Number DE88001188/JAW.

This document summarizes the research and development activities sponsored by the DOE Wind/Ocean Technologies Division during fiscal years (FY) 1986 and 1987. The summary is organized into the following sections: An introduction to the Federal Wind Energy Program, its history, and current research directions; The program's organization for FY 1986 and 1987; The program's budget; The highlighted accomplishments of DOE's field laboratories; The program's future role; An index to and summaries of individual projects and contracts managed by each laboratory; A bibliography of major publications produced by DOE and its laboratories in FY 1986 and FY 1987.

4332 **(NRC/E—TM-WE-33) Wind energy research and development at the National Research Council of Canada, 1975-1985.** Chappell, M.S. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1987. 181p. (MICROLOG—88-04445). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Research on wind energy systems began at Canada's National Research Council (NRC) in 1966. Initial efforts proved the concepts underlying the technology of vertical axis wind turbines (VAWTs) and confirmed their suitability for electrical generation

applications. Following the 1973 oil embargo, activities were incorportated into the broader NRC program of energy research under the auspices of the Interdepartmental Panel on Energy R&D (PERD). From 1975 to 1985 the NRC wind energy program continued the development of he VAWT through tests on small models and joint field trials of significant size prototypes in cooperation with potential users such as utilities. Increased understanding of the basic charcteristiscs of the wind resource and the energy conversion systems led to creation of analytical models from which design tools and techniques evolved for use by Canadian industry. Prototype commercial units up to 0.5 MW rating were under test by fall 1984 when the decision was taken for NRC to eliminate its PERD-related energy research activities. This report chronicles the technical and infrastructural aspects of the program, describes the nature and extend of wind energy resources in Canada, outlines the basic characteristics and primary relationships of the technology, provides a current synopsis of the state-of-the-art of wind turbine technology in Canada, and enumerates priorities and recommendations for further development. It presents a prespective on Canadian achievements and opportunities through summaries of the major wind energy activities in other countries through summaries of the major wind energy activities in other countries of the Western world. 231 refs., 33 figs., 13 tabs.

4333 **(NRC/E—TM-WE-34) Wind energy research and development at the National Research Council of Canada, 1975-1985.** Chappell, M.S. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1987. 196p. (In French). (MICROLOG—88-04446). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Research on wind energy systems began at Canada's National Research Council (NRC) in 1966. Initial efforts proved the concepts underlying the technology of vertical axis wind turbines (VAWTs) and confirmed their suitability for electrical generation applications. Following the 1973 oil embargo, activities were incorportated into the broader NRC program of energy research under the auspices of the Interdepartmental Panel on Energy R&D (PERD). From 1975 to 1985 the NRC wind energy program continued the development of he VAWT through tests on small models and joint field trials of significant size prototypes in cooperation with potential users such as utilities. Increased understanding of the basic charcteristiscs of the wind resource and the energy conversion systems led to creation of analytical models from which design tools and techniques evolved for use by Canadian industry. Prototype commercial units up to 0.5 MW rating were under test by fall 1984 when the decision was taken for NRC to eliminate its PERD-related energy research activities. This report chronicles the technical and infrastructural aspects of the program, describes the nature and extend of wind energy resources in Canada, outlines the basic characteristics and primary relationships of the technology, provides a current synopsis of the state-of-the-art of wind turbine technology in Canada, and enumerates priorities and recommendations for further development. It presents a prespective on Canadian achievements and opportunities through summaries of the major wind energy activities in other countries through summaries of the major wind energy activities in other countries of the Western world. 231 refs., 33 figs., 13 tabs.

4334 (NRC/E—TM-WE-029, pp 251-256) **Wind energy activities at the Instituto de Investigaciones Electricas.** Borja, M.A.; Caldera, E.; Borja, R.E. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

This paper outlines the wind energy activities carried out by the Electric Research Institute of Mexico since 1977. Present projects are in the areas of wind prospecting and site selection, development of instrumentation systems, marketing, systems and applications studies related to water pumping and electric power generation, and development of wind energy conversion systems compatible with Mexican conditions and needs. There is an experimental test site with three towers for machine mounting, a wind tunnel, and a mobile workshop for installing and testing wind turbines. Specific objectives include a low cost, high efficiency system for domestic and agricultural water pumping, and a wind turbine generator/electrical pump system in the 10-50 kW range for potable water and irrigation.

1701 Availability (climatology)

4335 (CANWEA—8801, pp 5-9) **Wind energy in Alberta: availability and reliability.** Jones, M.-E. (Small Power Producers Association of Alberta). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper discusses the general characteristics of wind energy available in Alberta. Southern Alberta has the highest average annual wind speeds, although wind energy is very site specific and good sites are possible in other parts of the province. Diurnal and annual trends are illustrated, and the reliability of wind data (generally collected from sites at airports, which tend to be located in non-windy areas) is evaluated. Estimates of the wind power potential of Alberta are reviewed; studies have shown at least 300 MW of economically realizable potential by the year 2000. 10 refs., 2 figs.

4336 (CONF-8703301—, pp 1-9) **Determining the wind energy available for selecting the site of wind power plants.** Tetzlaff, G. (Hannover Univ. (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Judging the wind energy available from the atmospheric flow for selecting the site of a wind energy converter is problematical and usually uncertain. A survey of determining the wind energy available is concerned with geotropic wind. Mesoscale flow, the wind field near the ground in the horizontally homogeneous case and the atmospheric flow in the horizontally non-homogeneous case are then dealt with. It was found that the description of the atmospheric flow at each individual site is affected by the flow processes on all large scales. (HWJ).

4337 **(CSTB-EN-CLI—87-1-L) Wind potential and turbulence characteristics on the site of Lastours.** Flori, J.P. (Centre Scientifique et Technique du Batiment, 75 - Paris (France)). 1987. 40p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88754678/JAW.

Fine wind acquisition campaign and permanent measurement of mean wind speed and direction were made from June 1985 to October 1986 at Lastours (Aude) on a site of complex topography. Annual mean wind speed at 30 m, potential wind energy and the annual energy output for the Ratier Figeac aerogenerators were calculated. Fine wind characteristics at 3 levels (speed profile, direction fluctuations, turbulence scale and intensity, spectral functions) are described. We observe a high wind potential on the site and that the flow characteristics are mainly influenced by the surroundings macro-roughness.

1703 Regulations

REFER ALSO TO CITATION(S) 4609

4338 (CANWEA—8801, pp 355-359) **The tax perspective.** Shepherd, J.C. Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

The Canadian tax incentives for wind energy projects are described in this paper. One of these incentives lies in writeoffs of capital costs available under Class 34 of the Income Tax Act, and the other in research and development credits and deductions available for activities at earlier stages. Despite the fact that these are valuable incentives, the Canadian wind power industry is not using them to any great extent. The reasons why Class 34 is sparsely used are discussed. The most critical reason is a lack of agressiveness on the part of the industry in going after this benefit, which is economically equivalent to a cash grant of 40-45 cents on the dollar against the cost of a wind installation. The research and development tax credits and deductions have an even larger equivalent benefit, but the delaying and obscuring of access to opinions on the technical qualification of projects under Revenue Canada's rules, and the low credibility of research and development programs in the investment community, create barriers to use of these incentives by the industry. The paper also discusses the impact of tax reform on the wind power industry. One aspect of the reform is that it has restricted tax incentives to essentially just the two previousy mentioned. A negative effect of the reform is that, in reducing tax rates, the attractiveness of tax deductions for investors has also been reduced. Two technical changes proposed in tax reform will also have an impact: issue costs will no longer be deductible immediately, but will be spread over 5 years; and the timing of the acquisition of capital properties has been changed.

4339 (NRC/E—TM-WE-029, pp 75-80) **Approval of wind turbines - status 1985.** Jensen, P. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The licensing procedure for wind turbines in Denmark, coupled to a policy of subsidy, has played a significant role in Danish windmill development. This licensing procedure has emerged from a liberally administered set of a modest number of general rules to a stage where more detailed requirements are more rigorously administered. A brief history of the licensing and subsidization of windmills is given, along with an outline of the fundamental requirements for stall-regulated windmills as specified in the original legislation. Later requirements are also described; these include emergency shutdown, power regulation, grid connection and cut-in, failsafe security, and braking systems. 2 refs., 3 tabs.

1704 Economics

REFER ALSO TO CITATION(S) 4357

4340 (CANWEA—8801, pp 361-366) **The utility perspective.** Martin, J. (TransAlta Utilities Corporation). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes the concerns and responsibilities of TransAlta, an Alberta electric utility, towards interconnection with non-utility power producers, such as small wind power producers. Any interconnections have to be done in conformity with TransAlta's responsibilities to customers and governments. A non-utility generation project must stand on its own merits and must not create opportunity for potential problems with similar future projects; thus, TransAlta carefully considers any precedents that any unusual interconnection project may set. To ensure that non-utility generation provides safe, reliable, low cost elecricity, guidelines have been established in three main areas of concern: technical, contractual, and economic. The first two concerns are briefly outlined, and economic concerns are described in greater detail. These latter concerns deal with the costs of the equipment needed for interconnection, the insurance costs, and power purchase rates.

4341 (CANWEA—8801, pp 247-264) **Prince Edward Island wind farm study.** Lodge, M.A. (Resource Ventures Inc., Charlottetown, P.E.I.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A survey of potential sites for wind farms in Prince Edward Island was carried out and two representative sites were selected for monitoring and assessment of wind energy resource. A steady decline in the cost of electrical energy purchased during the study period has had an adverse effect on the potential viability and attractiveness of a wind farm on the Island. The capital cost of developing a 2 MW wind farm was estimated at $2.6-3.7 million, and a 5 MW farm at $5.7-9.1 million. The low estimate reflect an untried but innovative vertical-axis machine from Adecon Energy Systems of Toronto, and the high estimate based on data provided by Vestas, an experienced Danish manufacturer. With the lowest cost alternative, a publicly-owned company would have to sell power at $79-88/MWh. Assuming that electricity prices will rise in the future from the present $26/MWh value to $50/MWh, a subsidy of 50-55% of the capital cost of a wind farm would be required to make the system economically viable. This is beyond the financial capability and interests of the province at present. 3 refs., 9 figs., 3 tabs.

4342 (CONF-8703301—, pp 109-122) **Conditions and need for negotiation in energy policy.** Kohler, S. (Oeko-Institut, Inst. fuer Angewandte Oekologie e.V., Freiburg im Breisgau (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

The use of wind energy has attracted little attention in the official energy policies so far. It is estimated that by the year 2000 about 4 to 7% of primary energy comsumption could be covered by regenerative energy sources. The energy economy regards State help as necessary for using these renewable energy sources. Varying energy supplies from wind energy converters could be accommodated on the grid without any problems. The monopoly of energy supplies tied to transmission lines is regarded as an obstacle in this context. There is reference to relevant wind energy converter-network plans. (HWJ).

4343 (CONF-8703301—, pp 211-220) **Selected economic questions using the example of wind power plants on the market.** Jenke, T. (M.A.N. Technologie G.m.b.H., Muenchen (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

State grants and private capital have led to considerable success in using wind energy in the USA (California) and in Denmark. The annuity method belonging to the dynamic methods of investment calculations is recommended for evaluating the costs of the 'wind power plant' as an economic article. In this process, average annual capital flows are determined for the whole period of investment. In a mathematical operation, the individual 'capital value' is converted into a series of figures with constant terms. There is a report on the practical application of the process, together with diagrams and tables. From the results of the calculation, with full State support, the use of wind energy would represent a sensible supplement to our primary energy. (HWJ).

4344 (SEC—8103) **Potential for megawatt scale wind power plants in electrical utility systems.** (Slater Energy Consultants, Inc. (Canada)). Mar 1981. 33p. (CE—02003). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The main objectives of this study were to estimate the economic potential for megawatt scale wind turbine generators (WTGs) in Canada's electrical utilities to the year 2020, and to

identify issues and activities having a bearing on the realization of this potential. The study included evaluation of the worth of WTGs in projected future systems of 3 key provinces. The study also included an analysis through the literature of potential problem areas, and the testing of public attitudes towards WTGs. Two WTGs under development were chosen for the study: the Hamilton Standard horizontal axis machine and a Canadian Darrieus machine. Detailed evaluations of the benefit of WTGs showed that, in the 3 hydrothermal utilities studied, their economic potential approached or exceeded the amount of wind generation that could be tolerated on these systems under an assumed single contingency security criterion, which would limit wind generation capacity to an amount equivalent to conventional generating capacity equal to 10% of the peak load. Evaluation of sources of nonhydraulic energy for hydraulic utilities indicated that, with the known wind regimes in the chosen provinces, only Quebec has enough winds to be able to use WTGs effectively. With this analysis, the total Canadian potential for economic employment of WTGs was estimated at 6,000 MW in the year 2000 and 17,000 MW by 2020. It was also concluded that the assumptions used in WTG evaluation produced conservative estimates of the benefits of wind generation. 11 figs., 10 tabs.

1705 Environmental Aspects

4345 **(CONF-861062—14) Acoustic noise and electromagnetic interference produced by wind generators: experimental investigation at an ENEL's wind power station in Sardinia (Italy).** Demichelis, F.; Fiorina, M.; Marini, R.; Truzzi, G. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Oct 1986. 8p. NTIS (US Sales Only), PC A02. Order Number DE89770031/JAW.

From European wind energy conference; Rome, Italy (7 Oct 1986).

Within the framework of the ENEL (Italian Electricity Board) research project on wind generators (the VELE Project), particular attention is being paid to the problem of environmental impact. The report summarizes an experimental investigation, performed at Alta Nurra (Sardinia), ENEL's pilot plant, where a set of ten 50-kW wind generators, characterized by relatively large nonmetal blades with a high rotating speed, are in operation. As regards electromagnetic interference, after a short general analysis of the phenomenon, the paper reports on the results of a series of television interference measurements performed in the 200-500 MHz frequency range, in various positions around a wind generator, and expressed as TV image degradation on a television set and as received signal modifications. As regards acoustic noise, after a general analysis of the problem, since one of the more critical noise components is known to be the interaction between the blade and the tower wake, the paper reports on the results of measurements on noise emitted by machines of identical design, but mounted on different towers.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 4336, 4345

4346 (CANWEA—8801, pp 303-313) **Wind Energy Program overview.** Carpentier, M. (Energy, Mines and Resources Canada). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This presentation summarizes the research and development programs within the Wind Energy Program of Energy, Mines and Resources Canada. The most important current directions are in the areas of wind/diesel hybrid systems, operation of wind turbine test sites, wind turbine development, basic research in structural and aerodynamic modelling of wind turbines, and development of standards. A number of demonstration projects were implemented under the Enerdemo program and the Remote Community Demonstration Program. The five most important of these demonstration projects are: a 65 kW wind turbine installed in Kuujjuaq, northern Quebec, and connected to the Hydro-Quebec grid; a 60 kW wind turbine installed at Fort Severn in northern Ontario; a wind farm located at Cambridge Bay, Northwest Territories; a hybrid wind/diesel system used to power telecommunications sites in British Columbia; and two wind generators connected to a local grid to supply power to a nursing station in Hall Beach, Northwest Territories.

4347 (CANWEA—8801, pp 274-301) **Stochastic wind effects on vertical axis wind turbines.** Marchand, O.; Brahimi, M.T.; Paraschivoiu, I. (Ecole Polytechnique de Montreal, Que.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper introduces a stochastic wind model into the double-multiple streamtube model in order to predict more accurately vertical axis wind turbine response characteristics. The CARDAAV computer code based on the double-multiple streamtube model was used for determining the interference factors in the induced velocity on the upwind and downwind zones zones of the rotor and hence for estimating the aerodynamic forces. This computer code included the so-called secondary effects as well as the blade geometry and profile type, the rotating tower and the presence of struts and aerodynamic spoilers and vertical variation in the freestream velocity can be accounted for. The CARDAAV code is first required to calculate the deterministic periodic flow velocities, independent of wind turbulence, then they are mixed with those of the stochastic simulation to yield total velocities. The fluctuation velocities, due to the atmospheric turbulence, are represented by a Fourier time-series. The Fourier coefficients are given in terms of spectral power density, the frequency band and a random phase angle for a specified rotor blade section. The work presented in this paper is to compare the double-multiple stream-tube predictions including stochastic wind effects with experimental data for a Sandia 17-m Darrieus machine. Thus, the paper compares forces using a turbulent wind with those calculated by using a constant ambient wind and also with the field experimental data at tip speed ratio of 2.33, 4.60 and a rotational speed of 38.7 rpm. 18 refs., 15 figs.

4348 (CANWEA—8801, pp 265-272) **Darrieus strut modifications.** Salt, D. (Indal Technologies Inc.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes the modifications made to a 500 kW Darrieus wind turbine tested in Canada. Blade failure had occurred due to higher stresses than expected, caused by a combination of strut lockup and stress risers. The failure would not have occurred as soon as it did, had the operating stresses not exceeded those measured in the original design. The new rotor configuration involved new struts, and improved attachments of the struts to the blades and the column. The new struts were of an I-beam type of construction, and new hinge blocks were used for installing the hinges connecting the struts to the blades. These modifications increased the safety margins of the rotor by lowering the component stresses. In addition, the new struts go through the column in the plane of the blades 18 inches further from the center of the rotor than the original struts. Particular attention was paid to the strut-to-blade connection, and this portion of the blade was strengthened by bonding four doublers on each side. The new rotor design has been tested since April 1987, and so far the experimental results agree with predicted results. 2 refs., 4 figs.

4349 (CANWEA—8801, pp 243-246) **Wind electric water pumping - an update.** Edworthy, J; Bourns, M. (Nor'Wester Energy Systems Limited). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes the performance of a wind turbine/water pump system as tested at the Lethbridge, Alberta Wind Re-

search Test Site. The system consists of a wind electric turbine, battery charging controller, battery bank, inverter and water pump. The system enables flexible siting of the wind turbine, and provides standard 120/240 volt ac energy for use with off-the-shelf pumps and other tools at the pump site. Due to operating difficulties associated with inverter failure in the spring, performance was only monitored when the site was not particularly windy. Few hourly averages showed the full delivery rate, due to cycling of the system. The cycling occurred because wind speeds were not high enough for a sufficient period of time to allow not only water delivery, but full charging of the batteries. There was sufficient energy to drive the system for a period, with a small storage capability, but the system was not being cycled fully from discharge to full charge. Peak pumping rates varied from 1.24 m/s to 2.07 m/s. When the batteries were charged to nearly operational state, a wind speed of 5 m/s was required to bring the system into operation. Despite the system complexity, it does work and does deliver water well, even at low wind speeds. 4 figs.

4350 (CANWEA—8801, pp 225-241) **Evaluation of small scale wind turbines for pumping water.** Paterson, B.A. (Lethbridge Wind Research Test Site). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

The Lethbridge Wind Test Site conducts testing programs to evaluate the potential for wind turbines to efficiently pump water for agricultural uses, and to monitor, demonstrate and evaluate various types of wind pumping equipment developed, manufactured or distributed in Canada. The site also has two solar pumping systems and one electric generating turbine under test. This paper describes the activities and future plans of the site. During 1986, eight wind turbines were installed, 7 of which were water pumping and one electric generating. These turbines represent a good cross section of machines currently available on the market. Monitoring equipment was used to evaluate performance, and this equipment includes atmospheric sensors, flow meters, rotor speed sensors, and computerized data acquisition and analysis. Operational performance of the wind powered pumps is summarized, and performance curves are included for five of the units. 9 figs.

4351 (CANWEA—8801, pp 181-202) **Atlantic Wind Test Site activities.** Brothers, C. Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

The Atlantic Wind Test Site was established in Prince Edward Island in 1981 to provide Canada with a facility to test and to aid in the development of wind related technology for Canadian application. This paper describes the site facilities, including the data acquisition system, and the current research activities at the site. Demonstration projects include Project Aquilo, a 500 kW vertical axis turbine, and a wind/diesel hybrid system. Testing is being carried out on two 25-kW horizontal axis turbines, Heli-o-Beauce and Monopteros. Work is also being done on developing standards for wind turbines. 4 refs., 7 figs.

4352 (CANWEA—8801, pp 169-180) **An inventory of wind turbines in Canada.** Hoffman, D. (World Wind Communications Co.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CE—02009; CONF-8709374—).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

The number of wind generators erected in Canada since 1970, and their generating capacities are tabulated by province and territory in order to document progress in commercializing wind power technology. Data for both the number of turbines and generating capacity are broken down into four lesser categories: amount installed per year and accumulated from all previous years, amount dismantled each year and accumulate remainder, amount confirmed still in operation during 1987, and status unknown in 1987. Since 1970, 258 windplants (except prototypes and machines of unknown generating capacity) totalling over 1,370 kW have been installed across Canada. Eighty-nine of these units, totalling over 170 kW, have reportedly been dismantled over the period, leaving 169 units totalling 1,195 kW possibly still standing. The status of 57 units (159 kW) out of the 169 machines is not known but the remaining 113 units (1,025 kW) are confirmed to be operational or about to be operational again after an interruption in service. An analysis of trends illustrated by the tabulated data is undertaken, and observations about apparent market trends are presented. 5 refs., 2 tabs.

4353 (CANWEA—8801, pp 165-167) **Developments in single-bladed rotors.** Kerr, C.C. (Thermax Energy Corporation Limited, Vankleek Hill, Ont.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

An outline is made of the characteristics, advantages and disadvantages of single-bladed horizontal axis wind turbines. Such turbines have a counterweight opposite the blade for balanced rotation. They operate at higher rpm, resulting in lower torque. This means the generator gearing-up ratio can be smaller and the main shaft lighter, and the natural resonant frequencies of the tower are further removed from the vibrations induced by the rotor. The rotor blade can be articulated to move front-to-back, thus lowering stresses and decoupling the rotor from the tower. A disadvantage of the rotor is its cyclic variation of angular velocity, which is a problem for synchronous generation. 1 fig.

4354 (CANWEA—8801, pp 147-164) **Preliminary investigation of potential icing effects on wind turbines.** Kolomeychuk, R.J. (The Environmental Applications Group Limited). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A preliminary investigation of the potential effects of icing on wind energy conversion systems (WECS) was undertaken for the Arctic, sub-Arctic and coastal areas of Canada. Specifically, an analysis of freezing rain and potential in-cloud icing was conducted for selected locations in the above geographic regions. Potential wind energy loss was determined during icing events and afterwards if the temperature remained below freezing. It is assumed that ice would remain on a WECS if the air temperature was less than 0/sup 0/C. The data used for the analyses were obtained from the Atmospheric Environment Service's climatic archive. Mean durations of icing events for all stations ranged from 2 to 4 hours; however, the duration of temperatures less than zero after an event ranged in average from 10-20 hours. The analysis of potential energy loss due to icing indicated that up to 10% of potential available energy could be affected. Of the 25 locations investigated, ten had potential energy losses of 4% or more. These are conservatively low values since meteorological stations are situated in low lying areas and do not provide representative data of the more severe conditions at higher elevations. 12 refs., 1 fig., 5 tabs.

4355 (CANWEA—8801, pp 129-146) **Fatigue analysis program for wind turbines.** Keller, J. (National Research Council of Canada, Ottawa, Ont.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A software program to estimate the lifetime of a wind turbine structure, based on actual stress data, rainflow counting, and Miner's Rule was developed. The statistical method of analyzing stress data for fatigue lifetime estimates called RAINFLOW has distinct advantages over methods employing spectra and average peak stress data, as these methods do not include stress excursion, speed variation, or turbulence effects on the structure which are inherently included in the rainflow methodology. Because of the nonlinear aspects of fatigue damage accumulation, turbulence effects are believed to cause a substantial reduction in the life expectancy

of wind turbine structures. This paper describes the software algorithm employed, along with examples of the programs' various graphical displays and tabulated results. Actual calculations from the Indal Technologies first generation 500 kW turbine are presented. This turbine, located at the Atlantic Wind Test Site in Prince Edward Island, experienced a fatigue failure near the upper strut-blade connection after approximately 3,000 hours of generating time. The fatigue life program was validated using data obtained a few weeks before the blade failure. The effects of the average wind speed, the Weibull factor, and cut-out wind speed on the life expectancy of the turbine are discussed. 7 refs., 9 figs., 1 tab.

4356 (CANWEA—8801, pp 376) **The influence of vortex flaps and leading edge snags on the performance of delta-wing bladed wind-turbines.** Kentfield, J.A.C. (Univ. of Calgary, Alta.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A brief description is given of the concept of the delta-wing bladed rotor (abbreviated to delta-turbine). It is explained that this relatively new form of horizontal axis rotor is intended for water pumping applications. Delta-turbines employ flap-equipped, sharp-edged, fixed-pitch delta-wing like blades. The paper deals, specifically, with the influence, on rotor performance, of adding vortex flaps, and leading edge snags, to a delta-turbine. The influence on the aerodynamic performance of a single delta wing, mounted in a wind tunnel on a lift and drag balance, was first investigated using various vortex flaps and leading-edge-snag configurations prior to advancing to trials with a model, dynamometer equipped, wind turbine rotor. Tests with a complete, 514 mm (20.25 in) diameter, model delta-turbine showed that performance benefits were obtainable with vortex flaps, deflected towards the blade pressure surface, located on the inboard edge of each blade and flap and also on the outboard edge of the flaps only. These additions to the model rotor increased the peak power coefficient from 0.36 to 0.39. An additional performance increment, resulting in a maximum power coefficient of 0.4, was obtained by adding leading edge snags to the outboard portion of each blade leading edge. 7 refs., 14 figs.

4357 (CANWEA—8801, pp 110-117) **High energy Darrieus rotor.** Malcolm, D.J. (Indal Technologies Inc.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

The economics of wind turbines may be improved by limiting the peak power generated by the rotor in order to reduce the governing design requirements. This paper presents the findings of a study investigating the technical and economic feasibility of building a Darrieus rotor using new airfoil designs. Two types of new rotors were examined: one had a constant blade chord of 0.763 m with a tailored airfoil, while the other combined the tailored airfoil with a step-tapered chord resulting in a greater chord dimension near the upper and lower blade roots. The rated power of both rotors was ca 520 kW, and the output of each machine was calculated for wind regimes corresponding to North Cape, Prince Edward Island and to a site on the Magdalen Islands. Structural analyses and cost estimates were also carried out. It was found that considerably greater energy production at a relatively small increase in production cost can be achieved using the tapered chord rotor design. The greater cost effectiveness of the tailored airfoil rotors is most apparent in the lower wind regimes and those with Weibull distribution shape factors greater than 2. 5 refs., 4 figs., 1 tab.

4358 (CANWEA—8801, pp 99-107) **Monitoring results from four utility-connected wind generators.** Martin, J. (TransAlta Utilities Corporation). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

Since 1984, TransAlta Utilities has been monitoring selected wind generators of the seven currently interconnected with its electric systems. At the end of 1986, the second full year of data collection, two 5 kW wind generators, and a 40 kW wind generator, all in southern Alberta, were being monitored. In 1986, the monitored wind generators produced 128,298 kWh of electricity (124,898 kWh in 1985). They were actually generating electricity at some level for 37.5% of the time in 1986 (45.3% in 1985). Average capacity factor for the wind generators was 26.1% in 1986 (28.6% in 1985). During hours of peak electric system demand, the wind generators were operating on average at 24% of their rated capacities in 1986 (10% in 1985). TransAlta will continue to monitor these four wind generators until the end of the five year monitoring program in 1989. 9 figs.

4359 (CANWEA—8801, pp 89-98) **Wind turbine foundations in the Canadian north.** Hume, D. Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper begins with a description of the experiences in installing the foundations for a wind turbine in a northern Ontario community. An examination is then made of the types of soil conditions found in northern Canada and to identify suitable options for the foundations in each soil type. Cost estimates are also given for the various types of foundation designs. 6 figs., 2 tabs.

4360 (CANWEA—8801, pp 69-88) **Aerowatt International autonomous wind energy power plants: observations on the overall efficiency of such systems.** Noel, J.-M. (Aerowatt International). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes the operating aspects of Aerowatt wind energy power plants as used in remote communities. These plants use wind turbines, ac generators, inverters, and battery storage systems to deliver up to 35 kW of power. Criteria for designing and sizing a system for a specific application are discussed. Operating results are presented for two systems, located on islands in the Indian Ocean. These islands also have standby diesel generator systems. Satisfactory performance has been obtained, close to predicted values, and savings in diesel fuel have been achieved. 6 figs., 6 tabs.

4361 (CANWEA—8801, pp 57-67) **Fort Severn wind/diesel update.** Drewes, P. (Ontario Hydro). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A hybrid wind/diesel generating system has been installed in a remote Ontario community. It uses a 60 kW Howden turbine feeding into the local electric system consisting of three diesel generators of different sizes, with a programmable control system selecting the generator that best matches the electrical demand. Synchronization tests were successfully conducted, during which the wind turbine provided up to 75% of the electrical demand with no detrimental effects on the diesel generators. A two year monitoring program is now under way to evaluate the performance of the system. 6 figs., 2 tabs.

4362 (CANWEA—8801, pp 41-55) **Project Eole.** Quraeshi, S.; Richards, B. (Shawinigan Lavalin, Inc., Montreal, Que.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

A 4 MW vertical axis Darrieus wind turbine generator, designated EOLE, has been constructed near Cap-Chat, Quebec. This paper outlines the configuration of EOLE and its design specifica-

tions, including turbine, guy cables, drive train, generator and electrical system, control system, instrumentation, and operation/protection modes. 10 figs.

4363 (CANWEA—8801, pp 35-39) **Canada's Arctic wind farm: Cambridge Bay, year 1.** Edworthy, J.; Bourns, M. (Nor'Wester Energy Systems Limited). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

Cambridge Bay, a small community in the Northwest Territories, has obtained a wind driven electrical generating system consisting of an array of four Carter Model 25 horizontal axis turbines. A few modifications were made for Arctic operation, including low-temperature lubricants and an electric heater for the transmission. Special foundations had to be constructed to take into account permafrost conditions at the site. Installation was completed by September 1987 and the project is scheduled to be fully operational by January 1988.

4364 (CANWEA—8801, pp 376) **Status of the wind/diesel coupling: activities at Hydro-Quebec.** Reid, R.; Saulnier, B.; Barry, A.O.; Lavallee, M.; Martell, L.; Dube, B.; Drolet, A. (Hydro-Quebec). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes briefly the technico-economic background leading to wind/diesel coupling as a means of reducing the high annual operating deficit of remote power systems. With a no-storage high penetration scenario, using a reference case for Northern Quebec conditions, 54% of the fuel used to produce electricity can be displaced by wind energy. For some communities with better than average winds, up to 75% of the fuel currently spent to produce electricity can be displaced. A program schedule for implementation of such wind/diesel systems in Hydro-Quebec's remote networks is presented and discussed. Results of the achievements of the first two phases of this program are given, covering the Kuujjuaq project in Ungava Bay and the development and implementation of the no-storage high-penetration wind/diesel scenario at an experimental testing facility. The main goal of the Kuujjuaq project is to demonstrate the technical feasibility of the installation of a 65 kW wind turbine in the harsh environment typical of a northern diesel-electric network. The objective of the second phase of this program is to develop a regulation and control system that will allow wind turbines to supply all of the demand of the community, when sufficient wind power is available, the diesel being shut down, while maintaining and or/improving the quality of power. Some preliminary results are presented, demonstrating the transient response and stability of the high penetration no-storage wind/diesel scenario. These reults are based on real parameter values that will be used for the validation of the simulation model for the proposed scheme. 8 refs., 15 figs.

4365 **(CONF-861062—13) Wind generator power output limitation by blade pitch control.** Arcidiacono, V.; Corsi, S.; Lambri, L.; Tontini, G.; Zanotti, P. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Oct 1986. 10p. NTIS (US Sales Only), PC A02. Order Number DE89770030/JAW.

From European wind energy conference; Rome, Italy (7 Oct 1986).

The paper considers wind generator blade pitch control problems. Attention is focused on the objectives of rotor speed control and power limitation. The performances of the original blade pitch control system, adopted for the Alta Nurra experimental power plant, are then given. The inherent inadequacy of such a control system, which simply relies upon a speed governor to limit power at high wind speeds, is shown. Finally, the study and design of the solution adopted, which employs an additional limiting regulator to control power output, are presented. Some experimental results on the behaviour of this control system are also given.

4366 **(CONF-8604406—1) Wind energy in Italy.** Sesto, E. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Feb 1986. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770049/JAW.

From 4. Italo-soviet energy symposium; No City Given, Italy (21 Apr 1986).

This report deals with public and private sector involvement in the development of wind energy conversion systems in Italy. National research programs to investigate the possibilities of medium-sized and large wind-turbine generators, connected in parallel to the national grid, are presented.

4367 **(CONF-8703301—) Wind power.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie; Deutsche Gesellschaft fuer Windenergie e.V., Eckernfoerde (Germany, F.R.)). 1987. 224p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

15 lectures were given at the Wind Energy Conference 87, on the following subjects: Selecting the site of wind power plants; the effect of turbulence on power output of wind energy converters; effects of dynamics of wind power plants on the design and operating behaviour; optimized design of wind turbines with rotary pump; use of wind energy in Third World countries; possibilities, restrictions and limits of using wind pumps; testing a 30 kW wind energy plant in the Chinese People's Republic; conditions and need for negotiation in energy policy; control concepts for wind energy plants; speed control of wind turbines; dimensions of a wind power plant South Wind N 715; testing and survey of wind power plants as the basis for the authorisation process; development problems of autonomous wind-Diesel plants; concept of an optimized wind island network supported by a Diesel engine; selected economic questions using the example of wind power plant on the market. There is a separate abstract of the contents of each of the 15 lectures. (HWJ).

4368 (CONF-8703301—, pp 11-23) **Effect of turbulence on the output of wind energy converters.** Beyer, H.G.; Gerdes, G.J.; Schmidt, W. (Oldenburg Univ.' (Germany, F.R.). Fachbereich 8 - Physik). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Determining the mean hourly output of a wind energy converter depending on the hourly mean value of wind speed is difficult, as the wind speed is subject to great local variations whithin an hour and because the wind energy converter has a non-linear response to these variations. In order to avoid these difficulties, a process was developed which describes the behaviour of wind energy converters, based on the numerical integration of the non-linear movement equation. The wind field is described by formulae (turbulence, wind speed variations, spectrum density of output) and by checking this wind field description, wind energy converter modelling (including testing) and determining the output of the wind energy converter in the turbulent wind field. (HWJ).

4369 (CONF-8703301—, pp 25-44) **Effects of dynamics of wind power plants on the design and operating behaviour.** Kehl, K.; Bauer, J. (Fachhochschule Ostfriesland, Emden (Germany, F.R.); M.A.N. Technologie G.m.b.H., Muenchen (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Dynamic instability of wind power plant can lead to failure of the component. Such vibration phenomena occur on the rotor vane as flutter in bending and torsion or as impact-rotation flutter and as whirling flutter in the whole system. Using three wind power plants as examples, the dynamic internal and response conditions are made clear. Results of test shown in many diagrams of tower bending vibration, rotor vane impact bending internal vibrations, impact bending moments, rotor vane expansion and hub de-

flection for the GROWIAN, WKA-60 (Heligoland) and AEROMAN 12.5/33 wind power plants are submitted and explained. Oscillograms of the simulation of the operating behaviour of GROWIAN in nominal operation with extreme gusting and during start-up, no load running and shutting down are shown. (HWJ).

4370 (CONF-8703301—, pp 45-65) **Design near the optimum for wind turbines with rotary pump.** Gasch, R.; Kortenkamp, R.; Twele, J. (Technische Univ. Berlin (Germany, F.R.). Inst. fuer Luft- und Raumfahrt). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Equations are derived for wind pump systems with a mechanically driven rotary pump, using which a simple design near the optimum is possible. Using the similarity laws for wind turbines and rotary pumps, the optimum gear ratio, the wind speed for optimum overall efficiency and the wind speed for the start of delivery are calculated. Only data for the output coefficient c/sub p/ /sub opt/ and acceleration figure λ/sub opt/ at the best point are needed for the wind turbine family, and the rated data for the pump (rated speed, rotor diameter and power consumption and head at rated speed, both as function of the delivery flow), the geodetic head and the size ratio of turbine rotor and pump rotor are required for the pump family. The results from computer calculations confirm the validity of this simple design process. (orig).

4371 (CONF-8703301—, pp 67-75) **Use of wind energy in Third World countries.** Owsianowski, R. (Deutsche Gesellschaft fuer Technische Zusammenarbeit G.m.b.H. (GTZ), Eschborn (Germany, F.R.). German Appropriate Technology Exchange (GATE)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

After an introductory survey of the most important tasks of GTZ, a historical outline is given of the use of wind energy by wind power machines. There is then a section on the application of wind energy converters in developing countries. Data are given on traditional wind energy converters in developing countries and on regionally manufactured plants. Finally, there is a report on institutional support and securing the success of development aids (water supply, rural electrification, partner organisation, repairs, obtaining spare parts). (HWJ).

4372 (CONF-8703301—, pp 77-91) **Possibilities, restrictions and limits of the use of wind pumps - experience from projects with collaboration in Peru.** Haars, K. (Interdisziplinaere Projekt Consult G.m.b.H. (IPC), Frankfurt am Main (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

This is a report on the practical problems of carrying out wind energy projects which occurred during German collaboration with Peru. The most frequent causes of failure of the 200 plants in use there include broken pump linkages, worn piston seals and broken rotor vanes. They are due to failure of the automatic storm protection. The present main use of wind pumps in Peru is in watering cattle; it should be directed to irrigation. A table of specific supply costs is submitted. (HWJ).

4373 (CONF-8703301—, pp 93-108) **Testing a 30 kW wind energy plant in the People's Republic of China.** Dietrich, M.; Juergensmeyer, W. (Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

In the context of the German-Chinese cooperative project DAXIN (1980-1986) supported by the West German Ministry of Research and Technology, a wind energy plant with vertical axis of rotation (Darrieus rotor type) was built in 1985 north of Beijing in the People's Republic of China. This article describes the plant, its integration with the local electricity supply, test results and experience in Chinese conditions. The mechanical and electrical components of the plant were jointly designed and built. The supply network was provided by the Chinese. The site is on a hill about 70 m above the plain with free flow from the main wind direction.

4374 (CONF-8703301—, pp 123-139) **Control concept for wind energy plant.** Heier, S. (Kassel Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 16 - Elektrotechnik). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Wind energy will gain in importance for long term energy supply plans, if one succeeds in tying the output from wind power plants, depending on the weather, into existing electrical energy supply structures. Starting from the method of operation and structure of horizontal axis types, the important components of such wind power plants are explained, the requirements for them are outlined and the most important structures for control in various types of operation are shown.

4375 (CONF-8703301—, pp 141-155) **Stability and accuracy of speed controls by means of centrifugal controllers.** Mickeler, S.; Mayer, M. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Aerodynamik und Gasdynamik). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

The life of a wind energy plant is determined by good and safe output or speed control. The FLAIR 8 wind turbine is introduced, the rotor of which is controlled by a centrifugal force controller. The adjustment of the rotor vane around its pitch axis is done from the difference between actual and reference speeds. To neutralise the propeller torque, the isotropy of the inertia around the pitch axis is produced. One then obtains a rotor blade which can be controlled by a comparatively small controller. After 5000 hours of operation without fault, one is confident that this concept could be transferred to a larger scale (at present rotor length is 8 m). (HWJ).

4376 (CONF-8703301—, pp 157-169) **Dimensioning a wind power plant South Wind N 715 (15 kW).** Weidner, A.; Harders, H. (Suedwind G.b.R., Berlin (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

A newly erected, three vane, leeward wind power plant with a horizontal rotor axis which has a socalled impact linkage rotor, whose rotor vanes are linked to the hub, was tested. The bending load at the foot of the vane is considerably reduced in this type, so that operation of the rotor on the lee side of the tower without problems is guaranteed. The limitation of power at constant speed occurs due to the breakaway of flow from the vane. During the test phase, a computer-aided multi-channel measuring system measured wind speeds at various places of the wind power plant, its electrical output and the mains connection load and the mechanical load. The measurements showed that the measuring system and the wind power plant worked well, so that further plants of this type (7 m rotor vanes) are planned. (HWJ).

4377 (CONF-8703301—, pp 171-184) **Testing and survey of wind power plants as the basis for the authorisation process.** Richter, B. (Germanischer Lloyd, Hamburg (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

Wind power plants for electricity generation habe extraordinarily difficult supports, for which there are no reliable data as regards assumptions of loads. A considerable amount of research is therefore necessary in order to determine the actual loads by measurement. The lecture describes the extent of tests and surveys in

order to obtain permission to build in West Germany. The performance of a wind power plant is not tested in the context of the authorisation process, but is of the greatest interest to the operator. The pure test for building permission should therefore be supplemented by evaluation of the plant. A subsequent testing of the prototype to remove faults, is also essential.

4378 (CONF-8703301—, pp 185-195) **Development problems of autonomous wind-Diesel-plants.** Fritzsche, A. (Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

From the forecast development of global populations and energy demand, with a growing dominance of the developing countries, the article points to the necessity of concentrating on providing uncomplicated systems with a maximum fuel saving. The concept of the double fed generator for variable speed, which is driven by the wind energy plant (type with vertical axis of rotation) and from the Diesel engine, is the solution which, compared with the conventional concept, leads to a 20% reduction of the fuel consumption and an increase in the life of the Diesel engine.

4379 (CONF-8703301—, pp 197-210) **Concept of a wind island network supported by a Diesel engine optimized regarding economy and security of supply.** Holstein, E.; Wrona, M.; Glocksin, G. (Ingenieurkollektiv Wuseltronick, Berlin (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770011/JAW.

From Conference and operators' seminar on wind power; Didenburg, F.R. Germany (27 Mar 1987).

The components of a modular hybrid energy supply system must comply with a number of requirements, not all of which apply to other systems: The Diesel generator and the wind power plant must be able to supply the system on their own. It must be possible to integrate additional wind power plants or Diesel generators in the system. Energy stores which consist of batteries with inverters, must be possible to integrate later, as a bridging store can be advantageous for many, but not essential for all users, if it prevents frequent starting of the Diesel engine. Load shedding controls should be adjustable, as far as possible. The installation of individual components should require the minimum effort. The system is not centrally controlled; each unit has its own control unit which controls and monitors the state of the unit itself and its connection with the energy supply system.

4380 (NRC/E—TM-WE-013) **Computer programs for aerodynamic analysis of vertical axis wind turbine.** Kind, R.J. (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Nov 1982. 60p. (MICROLOG—88-04465). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $4.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A computer program for the aerodynamic analysis of vertical axis wind turbines (VAWT) has been developed by the National Research Council of Canada. The program has been designed to provide maximum flexibility and ease of use. It is operated interactively and little familiarity with computers is required of the user for successful running. This document is intended to provide an overview of the program and its capabilities. It is presented in terms of a description of the various configurations of VAWT that can be analyzed, a brief review of the aerodynamic theory used in the analysis and a description of the computer programs in terms of structure and usage. Detailed information on any of these aspects is available in supporting project documentation. 11 refs., 9 figs.

4381 (NRC/E—TM-WE-029, pp 231-250) **Wind Energy Program, AEI and ARS.** Nelson, V. (Alternative Energy Inst., Canyon, TX). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The program of the Alternative Energy Institute (AEI) in Texas includes: data collection, research and feasibility studies; development and testing of alternative energy systems; collection and distribution of information; and education through research, courses, seminars, and workshops. Primary emphasis has been placed on wind energy research. The Conservation and Production Laboratory, Agricultural Research Service (ARS) has a program of evaluation of wind turbines for irrigation pumping. AEI has an ongoing program of data collection on wind speed; AEI and ARS have a cooperative program to evaluate agricultural applications of wind turbines. AEI has a wind test center with space for 10-12 wind energy conversion systems. At present, 4 units are being operated, and aspects of turbine performance being investigated include energy output, power variation with pitch angle, surface roughness of blades, and tip brakes. The test center and ARS have computerized data acquistion systems. 11 refs., 2 figs., 2 tabs.

4382 (NRC/E—TM-WE-029, pp 217-230) **The UK National Wind Turbine Centre.** Johnson, A.G.; Smith, W.M.R. (National Engineering Laboratory, Glasgow). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The main objectives of the National Wind Turbine Centre in Scotland are to provide technical assistance to UK companies wishing to become established in wind turbine manufacture, and to promote those companies seeking to enter the home and overseas markets. This assitance includes independent accreditation of a machine's performance and reliability. A test site to aid in those objectives has been established near Glasgow. The site has three universal pads capable of accepting a variety of machine designs. Other facilities at the site include the data acquisition and analysis system and the power control and collection system. Data are collected on turbine performance, relevant meteorological conditions, and other parameters; the performance of the data system is designed to meet the accuracies and sampling rates given in International Energy Agency recommended practices. 9 figs.

4383 (NRC/E—TM-WE-029, pp 207-216) **Rutherford Appleton Laboratory Wind Test Site.** Bossanyi, E. (Rutherford Appleton Laboratory). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

Rutherford Appleton Laboratory (RAL) is a government-funded body in the United Kingdom which supports research in various areas of physics. Its Energy Research Group is, at present, mainly concerned with wind energy. The Group has three main roles: research support, coordination, and actual research. Support for research includes operation of a small wind turbine test site described in some detail in this paper, and the providing of access to software such as meteorological databases. Much of the Group's research is done in collaborative projects between RAL, universities and industry. The RAL test site contains 3 wind turbines, meteorological masts and anemometers, a diesel generator with programma-

ble load for wind/diesel experiments, and various data logging systems. 13 refs., 3 figs.

4384 (NRC/E—TM-WE-029, pp 195-206) **Testing program and windpower activities at Chalmers.** Carlson, O. (Chalmers Univ. of Technology, Goteburg). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

Research activities into wind power at Chalmers University in Sweden have concentrated on three fields: electrical systems and components for large wind energy conversion systems; evaluation of small windmills along with development of measuring techniques; and research and development of autonomous wind/diesel systems. Activities at the Hono and Fiskeback test stations are summarized; equipment tested includes a 15 kW turbine from Swedish Wind Energy Industries, a variable speed windmill, and smaller turbines for battery charging and for grid connection. 2 refs., 3 figs.

4385 (NRC/E—TM-WE-029, pp 165-194) **Short term measurements to investigate starting behaviour of water pumping windmills.** Horijon, J.; van Meel, J.; Pieterse, N.; Smulders, P. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

This paper deals with the short term (under 10 minutes) measurements of wind speed and rotor speed of a prototype windpump being tested in the Netherlands. The starting behavior in the field could not be predicted from laboratory measurements, mainly due to the rapid fluctuations of wind speed and direction, and the rapid response of the windmill to these fluctuations. Short term measurements can give more insight into this behavior. The particular objective of these studies was to examine the effect of a starting hole in the pump piston on the starting behavior. This hole was designed to decrease the starting wind speed; during normal operating speeds, the pump will lose some water through the hole, which is designed so that these losses at the design windspeed are 10%. The starting torque required by the pump will be smaller, the hysteresis between starting and stopping velocities will be smaller, and so the overall power coefficient curve will be better. One-second measurements were carried out, both with and without the starting hole in the piston. The effect on mean values of the averaging time is discussed, and the procedure for selecting the starting and stopping events from the measurements is presented. 5 refs., 7 figs.

4386 (NRC/E—TM-WE-029, pp 144-164) **Activities on CWD test fields during 1984-1985.** Pieterse, N.; van Meel, J. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

Consultancy Services Wind Energy Developing Countries (CWD) is an organization established and funded by the Netherlands Ministry of Development Cooperation. It aims at helping developing countries in their efforts to use and promote wind energy, and its emphasis is on water pumping windmills. The CWD has three test fields in operation in the Netherlands, where 10 water pumping windmills in total are being tested. Performance measurements of output and safety system functioning, as well as short-term measurements of peak rotating speeds and starting/stopping wind speeds, are being carried out. Commercially available wind pumps are tested, new designs are being developed, and other investigations, such as anemometer tests, are being conducted. Experiments are being conducted on developing a piston valve which remains open on starting (so that no water is lifted) and closes at the rotor cut-in speed. An outline is given of the manner in which CWD reports its test activities. 10 refs., 7 figs.

4387 (NRC/E—TM-WE-029, pp 123-144) **Italian test sites.** Gaudiosi, G. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

A number of test sites for wind turbines in Italy are described in this paper. Activities conducted at such sites include testing and evaluation of electrical power generation systems and water pumping systems. Small size machines, with rotor diameters under 15 m, and intermediate size machines, with power output of 100-500 kW, are being designed, developed, and tested. However, the large number of sites used for testing has meant high costs. The need for one national test site has been recognized; a site in southern Italy has been recommended. 13 figs., 3 tabs.

4388 (NRC/E—TM-WE-029, pp 111-122) **Some results of rotor blade measurements.** Molly, J.P. (German Aerospace Research Establishment, Germany). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

At the German test site for wind energy conversion systems, some statistically evaluated measurements were taken on rotor blades. It was found that power correction calculations done at the site showed significant differences between measured and corrected values. This effect, and the testing of pitch-controlled turbines, brought about the necessity of using a correction method differing from International Energy Agency recommendations. Windspeed-corrected values are proposed, instead of power-corrected ones. The main advantage of the method is that the asymptotic approach to the rated power, which is dependent on the power control quality, can be maintained and will not be cut off by the artificial power limit introduced by the IEA recommendation. Also discussed are methods used in measuring acceleration at the blade tip, and drag measurement of the rotor blade. 1 ref., 9 figs.

4389 (NRC/E—TM-WE-029, pp 105-110) **Spectra of wind power and electrical power output.** Mengelkamp, H.-T. (Geesthacht/GKSS Research Center). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The ability of a wind turbine to react to wind speed variations is determined by its overall inertia, a measure of which is the turbine's cutoff frequency. To determine the cutoff frequency, sampling measurements were made on two turbines: one-second averages of wind speed and instantaneous values of electrical power output were sampled at one-second intervals for an Aeroman turbine, and 0.5 second averages were used for a Windmatic turbine. This paper presents the data resulting from these investigations. Spectra of the wind power input and the electrical power output, normalized by their variances, are shown. Because of its heavier construction, the Windmatic turbine was expected to have a greater moment of inertia and hence a lower cutoff frequency. The data show the opposite. The operating status indicated by the mean power output at which the spectra were measured seems to deter-

mine the overall inertia of the turbine. Both machines operate at a constant rpm but the load, and thus the torque, rises with increasing wind speed. Consequently, the inertia of the turbine increases. Therefore, a comparison of the cutoff frequency or response length of different wind turbines is meaningful only if the spectra are taken at the same state of operation. For the machines considered, the best point for such measurements was found to be the wind speed at which the power curves intersect. A graph showing the response length as a function of power output and wind speed is thought to be an important information source for wind turbine evaluation. 3 figs., 1 tab.

4390 (NRC/E—TM-WE-029, pp 99-104) **The horizontal axis research wind turbine at Riso National Laboratory.** Krogsgaard, J. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The mechanical details of a horizontal axis wind turbine used for research in Denmark are described: bearings, brakes, shafts, support frames, rotor and hub, tower, and electrical equipment. Performance measurements are to be made on various parts of the system, mainly by strain gauges connected to a computer. A number of proposed projects in aerodynamics, structural dynamics, and power train measurements are briefly outlined. 10 figs., 1 tab.

4391 (NRC/E—TM-WE-029, pp 91-98) **Measurement of eigenfrequencies on windmills per lading.** [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

As part of the standard test program for windmills conducted at the Riso test station in Denmark, investigations are made of any possible dangerous vibrations that might occur in the structure under operation. This paper concentrates on this test program's activities in analyzing the important vibrational modes in the structure and the eigenfrequencies they represent. A method has been developed using a 2-channel spectrum analyzer. A 3-bladed horizontal axis windmill, the most common Danish design, is used to illustrate the most common modes, including bending and torsion of tower, flapwise and edgewise movement of blades, and torsion in the transmission system. Measurements are obtained from strain gauges mounted on the main shaft and blade roots. During operation, spectra are measured for power and for the actions of the strain gauges. Experience has shown that the eigenfrequencies can best be found from the blade-root gauges. Measurements using these gauges are also done when the rotor is not rotating. 2 refs., 10 figs.

4392 (NRC/E—TM-WE-029, pp 81-90) **The Wind/Diesel Development Program at Riso National Laboratory - status 1985.** Madsen, H. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

This paper reviews research and development work done at the Riso windmill test station in Denmark which investigated hybrid wind/diesel electric generation systems. Two wind/diesel systems are being developed: a 30 kW state-of-the-art system without energy storage, and a 25 kW advanced system with energy storage. In the testing program, a universal test facility is being established for wind/diesel systems; the two aforementioned systems are also being tested, and a standard procedure for testing such systems is being developed. Measurements of consumed active and reactive power are being made on the grid of Anholt Island. Basic research and development is being conducted in diesel system starting and stopping; system dynamics; control strategies; and system economics. The test station also does consultancy work with industry. 7 refs., 5 figs.

4393 (NRC/E—TM-WE-029, pp 65-74) **An overview of the activities in 1985 at the test station for windmills, Riso.** Petersen, H. (Riso National Laboratory). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

A brief outline is presented of the Danish test station for windmills, including general scope of work, staff and budget, industry relations, new facilities, and international relations. 10 figs.

4394 (NRC/E—TM-WE-029, pp 49-54) **An aerogenerator testing facility at IREQ.** Saulnier, B. (Institut de recherche d'Hydro-Quebec, Varennes, Que.). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The aim of the aerogenerator testing facility at the Hydro-Quebec Research Institute is to provide a broad reliable data base for validating simulation models currently under development at the Institute. The test program covers the dynamic characterisitics of the wind turbine: the guy wires and the mechanical and electrical drive train under various loading conditions, both steady-state and transient. The machine under investigation is a commercial vertical axis wind turbine modified to allow operation at variable speeds, with a three- or six-guy wire support at adjustable tension levels. The instrumentation, the electical wiring and the data acquisition and processing system of the installation are described. The test program and typical test results (parametric resonance) are presented and discussed. 5 refs., 3 figs.

4395 (NRC/E—TM-WE-029, pp 43-48) **Atlantic Wind Test Site update. North Cape/Atlantic Wind Test Site, P.E.I.** [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

The Atlantic Wind Test Site in Prince Edward Island is a national facility established to assist in the development and testing of wind energy technology in Canada. The site is exposed to a wide range of weather conditions typical of a maritime climate. This paper describes the site facilities and current projects. These include testing a 1 kW Bergey turbine for use as a battery charger and a 7.5 kW vertical axis machine used in supplementing the site's electrical requirements; a comparison of anemometry equipment; testing of a 16 kW horizontal axis turbine for installation in the Northwest Territories; testing a 500 kW Indal vertical axis turbine; and developing a low cost intermediate size vertical axis turbine having a lattice frame support structure. Future activities are discussed in the context of expected federal research budget cuts.

4396 (NRC/E—TM-WE-029, pp 9-42) **Evaluation of small scale wind turbines for pumping water in Alberta.** Paterson, B.A.; Baker, D.R.; Jensen, N.E. [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

In 1982 a study was initiated to evaluate the use of wind turbines in Alberta for water pumping, and to monitor, demonstrate and evaluate various types of wind turbines distributed in Canada. A test site was established near Lethbridge, with six different water pumping windmills installed and monitored on a continous basis. A number of parameters were monitored for each of the water pumping turbines, with volume of water pumped relative to wind speed being considered the most important. For a solar pumping system and a small electrical generating wind turbine later installed on the site, the important parameters were water pumped versus solar radiation and power output versus wind speed respectively. The results of this study, particularly the demonstration aspects, have exceeded expectations. Interest by farmers, industry, government, and the public has been high. The test program results showed considerable differences among the various types of units on the site. More importantly, the program points out the need to relate the pumping performance of each machine to the wind regime of a given region. The data point out that manufacturers should put greater emphasis on designing machines to capture the low end of the wind spectrum. A 2 mph difference in wind speed for startup between two of the pumps tested showed that the pump with the lower startup speed pumped at least 40% more water annually. The data monitored at the site, because it is based on international standards, can be extrapolated and used throughout most of the world. This has positive implications for the development of the wind turbine industry in Canada. 14 refs., 28 figs., 5 tabs.

4397 (NRC/E—TM-WE-029, pp 1-8) **Community activities in wind energy.** Nacfaire, H. (Commission of European Communities, Brussels). [1988]. National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $25.00 CAN; MF CANMET/TID, Energy Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN. (CONF-8508266—; MICROLOG—88-04410).

From 5. international meeting of test stations for small wind energy conversion systems; North Cape, Canada (21 Aug 1985).

This paper outlines the demonstration program on innovative energy projects sponsored by the European Communities and concentrates on programs in the wind energy sector. Realistic estimates for wind energy potential in Europe have indicated that this source could provide 2% of the Communities electricity by the year 2000. To enhance this possibility, financial aid is provided by the European Commission for the design, construction, and demonstration phases of wind energy projects. An overview of the projects submitted indicates that electricity production is the most significant application. The largest part of those projects aim at power production for island grids by medium sized wind turbines. Other activities, initiated by the Communities' Directorate-General for Energy, are: a critical and comparative study of wind energy legislation; a market study of small and medium sized wind turbines; and collaboration between national test stations for windmills.

4398 **(NRC/E—TM-WE-030) Effects of wind speed sampling and averaging intervals on accuracy of wind energy estimates. Atlantic Wind Test Site.** Brothers, C. (comp.); Arthur, H. (comp.). (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). 1985. 44p. (MICROLOG—88-04466). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $5.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Wind turbine site assessment requires prediction of wind energy from historical records or measurements of wind velocity. The complexity, cost, and reliability of wind speed measurements are dependent on the frequency and duration required, and on the nature of the preprocessing needed prior to recording. An extensive data bank of wind speed measurements are dependent on the frequency and duration required, and on the nature of the preprocessing needed prior to recording. An extensive data bank of wind speed measurements was recorded on the Atlantic Wind Test Site (AWTS) on Prince Edward Island at 1-s intervals for over 60 d. Wind speed histograms and duration curves were constructed from this data set for several snapshot intervals and several averaging periods. Energy and turbulence parameters were computed for the various sampling and averaging intervals and compared to corresponding parameters for the complete data set. Histogram and energy parameter calculations were repeated for a subset of data within the operating range of typical wind energy conversion systems (WECS). The results indicated that, for the total data set, snapshot sampling intervals up to 15 min resulted in energy errors of less than 1%; however, the same data averaged over periods of greater than 1 min resulted in energy errors of more than 4%. For the AWTS data set used the gross assumption of Rayleigh distribution resulted in an error in predicted wind energy of over 35%. Turbulence parameters showed similar trends. For the WECS operating range subset, energy parameter errors were less than 1% for snapshot intervals up to 5 min, but between 2% and 4.5% for the 15-min snapshot interval and for all averaging periods. 18 figs., 2 tabs.

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REFER ALSO TO CITATION(S) 4093, 4094, 4094, 4116, 4252, 4411, 4488, 4599, 4616

4399 **(CESI—86-8) Development and prospects of cables with reduced smoke and toxic and corrosive gas emission.** Dabusti, V.; Farneti, F.; Beretta, G.; Gasparini, G.; Ostano, P. (Centro Elecctrotecnico Sperimentale Italiano, Milan). May 1986. 7p. (CONF-8605354—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770045/JAW.

From 5. BEAMA - international electrical insulation conference; Brighton, UK (19 May 1986).

The paper outlines the solutions adopted to obtain cables with low toxicity, corrosiveness, smoke emission and fire propagation characteristics, for use in high-risk or high-cost facilities. In Italy, a new generation of polyolefin sheathed cables (developed mainly for use in power plants) meets the above mentioned requirements while maintaining the necessary electrical, mechanical and thermal specifications. The results of tests carried out to assess cable behaviour in the event of fire are also reported.

4400 **(CISE—3140) Control systems for on-line surveillance of steam turbogenerators.** Clapis, A.; Giorgetti, G.L.; Lapini, G.L.; Benanti, A.; Frigeri, C.; Gadda, E.; Mantino, E. (Centro Informazioni Studi Esperienze, Milan (Italy); Ente Nazionale per l'Energia Elettrica, Rome (Italy)). May 1986. 13p. (CONF-8605355—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770051/JAW.

From 2. international conference on on-line surveillance and monitoring; Venice, Italy (1 May 1986).

The paper describes the characteristics of computerized systems developed in Italy for continuous data acquisition and for the malfunction diagnosis of steam turbogenerator groups. These systems receive signals (vibration pressure, temperature, ect.) both from the standard machine sensors and from a set of purposely installed sensors, termed VIBRO. Data acquisition and storage is completely computer controlled by purposely developed software; the mass storage capacity is so large as to have long endurance and to follow the possible evolution of the machine conditions both in the short and medium terms. Data are acquired not only during normal operation at rated speed and power, but also during run-up and run-down transients; this is very important to obtain early diagnosis of several possible malfunctions. The same systems are also used to obtain, on new turbogenerators, the machine "baseline", that is, a set of data used as a reference to keep under control the

time evolution of the machine dynamic's behaviour. The vibration specialists are assisted in this task by special software developed for file management and graphic data display. The paper describes the general organization of the systems and some examples are given of field data acquired both in transient and rated conditions. The data are displayed in the graphic form typical of the systems.

4401 **(CISE—3145) PROP: an expert system for process control in thermal power plants.** Gallanti, M.; Pascali, R.; Bacci, F.; Quadri, G. (Centro Informazioni Studi Esperienze, Milan (Italy); Ente Nazionale per l'Energia Elettrica, Milan (Italy)). May 1986. 15p. (CONF-8605355—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770052/JAW.

From 2. international conference on on-line surveillance and monitoring; Venice, Italy (1 May 1986).

The impact of expert systems technology in the industrial process environment is well recognized. In particular, the development of advanced equipment, that acts as an intelligent assistant to the operator by supporting him in complex activities, is one of the most promising fields for the application of knowledge based systems. Referring to this field, we present the design and implementation of PROP, an expert system for on-line monitoring and diagnosis of process water quality in a thermal power plant. PROP, which acquires the data directly from the plant, through sensors and from the operator, through the console keyboard, timely detects and identifies pollutants and suggests proper interventions to the operator. The use of a knowledge based approach to tackle this problem gives many advantages. The most important one is that we can represent the knowledge about the domain at a higher abstraction level, and in a more flexible, effective and natural way in comparison with more traditional programming methods.

4402 **(CONF-881133—1) Investigation of alloys for advanced steam cycle superheaters and reheaters.** Swindeman, R.W.; Maziasz, P.J.; Judkins, R.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01. Order Number DE89002203/JAW.

From 2. international conference on improved coal-fired power plants; Palo Alto, CA, USA (2 Nov 1988).

Screening tests were performed on three groups of developmental alloys and compared to the alloy design and performance criteria identified as needed for alloys suitable as superheater/reheater tubing in advanced heat recovery systems. The three alloy groups included modifications of type 316 stainless steel, Fe-20Cr-30Ni alloys, and Ni-Cr-Fe aluminides. The screening tests were performed by the Oak Ridge National Laboratory, several university researchers, and industrial researchers and included fabricability, mechanical properties, weldability, and oxidation behavior. If mildly hot or cold worked, the modified type 316 stainless steels possessed excellent strength and ductility for times to 20,000 h, but possessed marginal weldability and oxidation resistance. The 20Cr-30Ni-Fe alloys also exhibited good strength and ductility, but showed marginal weldability tubing, and were marginal with respect to meeting several of the alloy design criteria. One stainless and one modified alloy 800H were produced as 50-mm-diam. tubing for further evaluation. 24 refs., 14 figs.

4403 **(CONF-8608184—1) Modelling and simulation of a pilot power plant fired with oil and coal-water fuels.** Maffezzoni, C.; Prandoni, W. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Mar 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770073/JAW.

From IFAC symposium on power systems and power plant control; Beijing, China (12 Aug 1986).

With the aim of testing the use of coal-water fuels for electric power generation, ENEL (Italian Electricity Board) promoted a pilot project based both on single-burner and on whole-unit tests. This paper describes the development and the different utilizations of a modular dynamic model of the boiler where whole-unit tests are being performed. Particular emphasis is given to the concept of multifuel furnace modelling and to its use for the prediction of boiler performance.

4404 **(CONF-8609451—2) Air-gas path modeling and controls for balanced draft boilers.** Corti, L.; De Marco, A.; Quatela, S.; Radice, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Jun 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770070/JAW.

From 2. IFAC workshop on modelling and control of electric power plants; Philadelphia, PA, USA (1 Sep 1986).

At ENEL (Italian Electricity Board), a few steam generators which ran as pressurized units for many years are now being converted to a balanced draft operation. In a balanced draft boiler, the furnace pressure has to be automatically controlled and the most critical demands upon the control are met in emergency conditions (boiler trip, load rejection). The analysis of the possible control strategies and the main control parameters has been performed by using a reference model of the air-gas system. The model, based on physical principles and correlations, is described by algebric and ordinary differential equations. It has been developed not only to design and verify the air-gas control system, but also to be used in engineering real time simulation of a thermal power plant in which emergency situations have to be studied. A suitable implicit integration technique has been developed, which allows large time steps to be used while still maintaining good accuracy (large number of control volumes) and high stability margins. The validation of the model is also shown. First, a load rejection test has been performed on a unit equipped with a pressurized furnace. Then, a seriesof tests on a balanced unit are shown, and comparisons made.

4405 **(CONF-8711245—1) A modular management system for industrial plants, CIM oriented based on MAP communication protocols.** Dadda, E.; Gavazzi, C.; Corini, G. (Gavazzi (C.) S.p.A., Milan (Italy)). Nov 1987. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770065/JAW.

From Workshop on computers applications for nuclear powers and industrial process plant operation and control; Rome, Italy (19 Nov 1987).

The need to develop manufacturing system flexibility inevitably leads to an increase in the use of industrial automation systems, factory services and management procedures of production line integration. The continuous process control systems and, above all, energy process control systems have remained on the borders of this evolution which has directly involved production lines. These "proprietary" systems, highly dedicated to application and "closed" towards other systems, have great strategic importance in the industrial process and require high investments. The system discussed in this report has been conceived to centralize and optimize energy autogeneration and distribution management in industrial plants. It is structured according to the levels proposed by the CIM (Computer Integrated Manufacturing) model and makes use of the MAP standard of communication (ISO-OSI model). Therefore, it can be defined as an "open" system based on international standards apt to assure the necessary flexibility to reach the objective of a full integration of manufacturing systems and sevices in industrial plants.

4406 **(EPRI-AP—5931) Cool Water Coal Gasfication Program: Fifth progress report.** (Electric Power Research Inst., Palo Alto, CA (USA); Cool Water Coal Gasification Program, Daggett, CA (USA); Radian Corp., Austin, TX (USA); Southern California Edison Co., Rosemead (USA)). Oct 1988. 336p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89001849/JAW.

The Fifth Annual Progress Report provides an update on the Cool Water Coal Gasification Program and supplements EPRI Report AP-2487 published in July 1982, Report AP-3232 published in October 1983, Report AP-3876 published in January 1985, and Report AP-4832 published in October 1986. Details on high sulfur coal testing and commercial operation through December 31, 1987, are described in this report on the 100 (net) MW integrated gasification - combined cycle (IGCC) demonstration plant. Process and materials performance, plant dynamic control modes, environmental monitoring and reliability/availability statistics are presented. Operational plans for the remaining 1-1/2 years of the 5 year program are outlined, along with current and forecasted capital expenditures. Sections are also included on safety and operator training. This document is the fifth in a series of annual reports on the progress of

the Cool Water Project, from design through testing and operations. 3 refs., 45 figs., 74 tabs.

4407 **(EPRI-CS—6013) Erosion in pulverized-coal conveying systems: Final report.** Johnson, T.D.; Low, M.B.J.; Parry, M.T.; Wall, D.J.; Hoadley, D. (Electric Power Research Inst., Palo Alto, CA (USA); Central Electricity Generating Board, Bristol (UK). Operating Engineering Div.; Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Sep 1988. 101p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89000441/JAW.

Erosive wear in pulverized coal distribution systems causes significant repair and maintenance costs and there is a strong economic incentive for the optimization of materials and installation methods. Following a survey of plant wear and a review of the influences of geometry and of the size and type of erosive species in pulverized fuel, an extensive laboratory, erosion test program is described. The test results are compared with the results of carefully controlled plant trials and modelling is employed to quantify the wear. For pipe elbows it is predicted, and generally found, that the maximum penetration rate occurs at a position dependent only on the bend radius to pipe diameter ratio. It is shown that the relative performance in laboratory test of materials of a similar type is reproduced in plant but that the tests tend to overpredict the wear of ceramics. The need for better understanding of the properties influencing the wear of ceramics is identified as is the need for careful design and installation. Nevertheless, sufficient information is now available to give guidance on the selection of materials for economic and long lasting lining systems. 20 refs., 52 figs., 23 tabs.

4408 **(NP—9770013) Planning and design of a combined-cycle power plant using advanced fluidized bed coal gasification processes with high carbon conversion rates. Final report.** Hemsing, H.; Jelich, W.; Dietrich, W.; Schroeder, G. (Deutsche Babcock A.G., Oberhausen (Germany, F.R.); Energie-Versorgung Schwaben A.G., Stuttgart (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jun 1986. 249p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89770013/JAW.

In the present final report the concept of a combined-cycle power plant with integrated pressurized fluidized bed gasification is described including the essential technical and economic data. Two different planning concepts are described: Construction of a new 300 MW combined-cycle power plant with pressurized fluidized bed gasification, conversion of an existing 300 MW combined-cycle power plant from oil to coal gas firing. For fuel gas production an advanced pressurized fluidized bed gasification (PFBG) process is used in which a carbon conversion rate of 95% is achieved by special coalchar recycling. As far as possible, components and systems today commerically available have been considered in the planning. Combined-cycle power plants with PFBG attain net efficiencies over 42% with an advanced gas turbine (ISO temperature 1 150/ sup 0/C). It turned out that the power plant efficiencies for gasification with air are markedly higher than those achieved when using pure oxygen. By the efficient cold gas cleaning under pressure very low emissions values for particulates, SO/sub 2/, NO/sub x/ and halogens are attained. The pollutant emission standards according to GFAVO and TAL are reliably met; the emission levels may be even below these standards. At the same investment costs the electricity production costs for the described power plant concept are approx. 10% lower than those for a conventional hard coal-fired power plant of equal size. (orig.) With 48 refs., 12 tabs., 52 figs.

4409 **(NP—9770072) Switching impulse performance of post insulators in polluted conditions.** Garbagnati,E.; Marrone, G.; Porrino, A.; Perin, D.; Pigini, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). May 1987. 5p. NTIS (US Sales Only), PC A02. Order Number DE89770072/ JAW.

Results of tests with switching impulses (SI) on post insulators in polluted conditions are presented. Insulators lengths from 4 up to 12 meters were tested. Heavy reductions of the switching impulse withstand voltage were observed in presence of contamination, especially when large dry bands were affecting the insulator surface. It is shown that the ratio between the SI strengths under polluted conditions and in clean and dry conditions is practically independent of the insulator length considered. It is also derived that the ratio between the SI strength and the Ac strength under polluted conditions decreases when increasing the insulator length.

4410 **(ORNL/TM—10206/P2) Procurement and screening test data for advanced austenitic alloys for 650{degree}C steam service: Part 2, final report.** Swindeman, R.W.; Goodwin, G.M.; Maziasz, P.J.; Bolling, E. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01. Order Number DE89001331/ JAW.

The results of screening tests on alloys from three compositional groups are summarized and compared to the alloy design and performance criteria identified as needed for austenitic alloys suitable as superheater/reheater tubing in advanced heat recovery systems. The three alloy groups included lean (nominally 14% Cr and 16% Ni) austenitic stainless steels that were modifications of type 316 stainless steel, 20Cr-30Ni-Fe alloys that were modifications of alloy 800H, and Ni-Cr aluminides, $(Ni,Cr)_3Al$. The screening tests covered fabricability, mechanical properties, weldability, and oxidation behavior. The lean stainless steels were found to possess excellent strength and ductility if cold-worked to an equivalent strain in the range 5 to 10% prior to testing. However, they possessed marginal weldability, poor oxidation resistance, and sensitivity to aging. The modified alloy 800H alloys also exhibited good strength and ductility in the cold-worked condition. The weldability was marginal, while the oxidation resistance was good. The aluminides were difficult to fabricate by methods typically used to produce superheater tubing alloys. The alloys that could be worked had marginal strength and ductility. An aluminide cast alloy, however, was found to be very strong and ductile. 23 refs., 19 figs., 13 tabs.

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REFER ALSO TO CITATION(S) 4094, 4116, 4133, 4675, 4942

4411 **(EPRI-CS—5161-Vol.1) Fabric filters for the Electric Utility Industry: Volume 1, General concepts.** Bustard, C.J.; Cushing, K.M.; Pontius, D.H.; Smith, W.B.; Carr, R.C. (Electric Power Research Inst., Palo Alto, CA (USA)). 1988. 38p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003005/JAW.

This publication is the first in a series presenting results of EPRI's research and development work applying baghouse technology to the collection of particulate matter at coal-fired electric power generating plants. The series, Fabric Filters for the Electric Utility Industry, is intended as a practical, hands-on reference for plant operators, engineers, and home office managers. Multiple volumes are planned, each to be produced sequentially over the period 1987-1989. Topics to be addressed include operating principles and terminology, baghouse design considerations, bags and fabrics, flue gas dynamics, reverse-gas cleaning, reverse-gas cleaning with sonic assistance, shake/deflate cleaning, pulse-jet cleaning, combined SO_2 collection, and operation and maintenance. Volume 1, General Concepts contains a discussion of fly ash formation, technologies for particulate control, baghouse operating principles and terminology, filtration mechanisms, the filtration process, and baghouse application in the US utility industry. 24 refs., 20 figs.

4412 **(EPRI-CS—5161-Vol.2) Fabric filters for the electric utility industry: Volume 2, Sonic cleaning guidelines.** Bustard, C.J.; Cushing, K.M.; Pontius, D.H.; Smith, W.B.; Carr, R.C. (Electric Power Research Inst., Palo Alto, CA (USA); Southern Research Inst., Birmingham, AL (USA); Electric Power Technologies, Inc., Menlo Park, CA (USA)). 1988. 63p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003006/JAW.

This publication is the second in a series presenting results of EPRI's research and development work applying baghouse technology to the collection of particulate matter at coal-fired electric power generating plants. The series, Fabric Filters for the Electric

Utility Industry, is intended as a practical, hands-on reference for plant operators, engineers, and home office managers. Volume 2, Sonic Cleaning Guidelines, provides practical guidelines for selecting, testing, and operating pneumatic, diaphragm-operated horns as a supplement to reverse-gas cleaning in utility baghouses. This volume includes a discussion of the effectiveness of various sonic horns in pilot- and full-scale testing along with costs and benefits of sonic-assisted reverse-gas cleaning. Guidelines are given for characterization and selection of horns for utility applications. Installations of horns, trial testing, operation, and maintenance are discussed. An explanation of the fundamental of sonic technology is provided. The sonic spectra and operating characteristics of commercial horns and a list of horn manufacturers are included to help in the selection of horns. 6 refs., 15 figs., 1 tab.

4413 **(EPRI-EA—6095-Vol.1) A hierarchy of dynamic plume models incorporating uncertainty: Final report, Volume 1: Overview.** Lewellen, W.S.; Sykes, R.I.; Parker, S.F.; Henn, D.S. (Electric Power Research Inst., Palo Alto, CA (USA); California Research Technology, Princeton, NJ (USA). ARAP Div.). Nov 1988. 202p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003021/JAW.

This volume presents an overview of the development and testing of our hierarchy of models designed to calculate the uncertainty associated with time-averaged sampler observations downwind of fossil-fueled power plants along with the calculations of expected concentrations. To accomplish this, we developed dispersion models at three levels of resolution. These span the range from a three- dimensional dynamical model of the buoyant plume to a Gaussian plume model. A random-walk puff dispersion model provides the intermediate resolution. All three models include a concentration fluctuation variance equation and provide the capability to represent the full probability distribution of expected concentration samples. A meteorological preprocessor which assumes horizontal homogeneity was used for obtaining most of the modeled results. But also a new 4-dimensional meteorological data assimilator, developed as part of this project, was utilized for some experiments. Model comparisons with EPRI's plume model validation data sets show consistent simulations of the expected statistical variation in one-hour surface samples downwind of two different coal-fired power plants. The higher resolution models did not show consistently better performance than the lowest resolution model. One explanation is that uncertainty in the ambient meteorological environment apparently had a large influence on model performance. Even so observations generally fall within the simulated 95% confidence bounds for all the models. This represents a major improvement in the statistical simulation of dispersion. 8 refs., 22 figs., 3 tabs.

4414 **(Juel—2180) Investigations of the solubility of harmful substances from coal fired power plants in liquid carbon dioxide.** Wuestefeld, R.E.E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung; Technische Hochschule Aachen (Germany, F.R.)). Feb 1988. 161p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755153/JAW.

The present utilization of coal, mineral oil and natural gas is causing an overall increase of the carbon dioxide concentration in the atmosphere. It has been proposed to burn fossil fuel compounds with pure oxygen and to liquefy the carbon dioxide, which is the main component in the product stream. The liquid can be used as a solvent for the other combustion products. This report describes the solubilities and vapor-liquid equilibria of typical combustion products in liquid CO/sub 2/. The experiments are made in an equilibrium apparatus, which can measure the solubility of solid, liquid and gaseous components in CO/sub 2/ at temperatures between -40 and +15/sup 0/C and pressures up to 70 bar. Coal ash is completely insoluble in liquid carbon dioxide. The experimental results are confirmed by solution theory. The vapor-liquid equilibria of the gaseous overcritical components N/sub 2/, CO, O/sub 2/ and NO in liquid CO/sub 2/ are shown in detail. Beside the data from literature, the system NO/CO/sub 2/ and CO/CO/sub 2/ are investigated experimentally. The solubility data of these two systems are well described by the Redlich-Kwong-Soave-Equation.

4415 (KFK-PEF—35-Vol.2, pp 669-679) **Development of a SCR-catalyst adapted to an instationary operation of the reactor.** Kotter, M.; Lintz, H.G.; Turek, T. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Chemische Verfahrenstechnik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

A new NO/sub x/ abatement strategy proposes the use of the Ljungstrom heat exchanger (Luvo) of the power plant as a reactor, impregnating its surface with the catalytic active phase. Impregnation type catalysts based on oxides of vanadia and titania show high activities both under steady state and transient conditions, however, wet impregnation does not allow to scale up the conditions of preparation. A new preparation method leads to an active, vanadia and titania containing phase with high specific surface area and intimate contact between the oxides. Durability tests in air show stability of the catalyst at the desired temperatures.

4416 (KFK-PEF—35-Vol.2, pp 695-708) **Development of an agglomerator for the elimination of flue gas aerosol.** Backhaus, A.; Conrads, M.; Wurz, D.; Zimmermann, M. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Technische Thermodynamik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Among the different methods for the elimination of aerosols wet scrubbing systems operate economically. A big disadvantage is, that particles with diameter between 0,05 μm and 0,5 μm are eliminated insufficiently because of the use of relative coarse wash droplets. Scrubbers working with a fine liquid spray are unusual, because fine droplets can till now only be removed from the gas flow with a large effort. Remedial measures can be taken by droplet agglomerators, which transform a fine wash liquid spray into comparatively coarse droplets. These droplets can easily be eliminated by common drift eliminators. The aim of this project is the development of an agglomerator, which has a high elimination rate, low energy consumption and a good performance in service. The agglomeration of wash droplets is more closely treated as one of the steps of a wet scrubbing system with an integrated droplet agglomerator. The results of the experimental investigations concerning five different types of agglomerators are presented and discussed. Droplets with $d>5$ μm are entirely caught and transformed into drops with a minimum diameter of 30 μm, on average into drops with a diamter of 150 μm. The pressure drop coefficients run between 2 and 8.5. For tests of the whole unit plant measurements with aerosol loaden flue gas were carried out. Spray nozzles with a frequency medium drop diameter of 100 μm (L/G-ratio of 0.8) and pneumatic atomizing nozzles with a frequency medium drop diameter of 20 μm (L/G-ratio of 0.5) were used. First analysis resulted in aerosol elimination rates of 40-50% using spray nozzles and 80-90% using pneumatic atomizing nozzles.

4417 (KFK-PEF—35-Vol.2, pp 709-728) **Combined separation and retainment of particulate and gaseous matter by fibrous filters.** Loeffler, F.; Gaeng, P. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Mechanische Verfahrenstechnik und Mechanik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The binding of gasses to fine-grain sorbents prior to and during their filtration with fibrous (e.g. bag) filters presents an economical possiblilty of reducing gaseous and particulate pollutants, generated by small and average-sized process plants, down to the limits stipulated by the environmental-control regulations. During the course of filtration with fibrous materials, a superficial cake is formed, itself serving as the true filter medium. Indeed, it is the presence of this cake which awards such filters their excellent col-

lection characteristics over the entire particle size range. Under favourable conditions, this extremeley pourous layer (ϵ≅0,8) can also be simultaneously employed as a reactor for the extraction of gaseous pollutants, such as SO/sub 2//SO/sub 3/, HCl and HF. The sorbents suited to this task include CaCO/sub 3/, CaO, Al/sub 2/O/sub 3/ or Dolomite, depending on which gas one desires to purge. This project is concerned with the theoretical and experimental investigation of the collection of particulate substances at elevated temperatures up to 600/sup 0/C and the reaction of gases within the cakes generated.

4418 (KFK-PEF—35-Vol.2, pp 739-754) **Aerosol formation and heterogeneous reactions in the simultaneous flue gas cleaning process by electron beams.** Paur, H.R.; Jordan, S.; Baumann, W.; Maetzing, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The electron beam dry scrubbing process removes simultaneously SO/sub 2/ and NO/sub x/ from exhaust gases forming solid ammonia sulfate and nitrate in the presonce of NH/sub 3/. The aerosol formation in the electron beam dry scrubbing process depends mainly on the parameters dose, relative flue gas humidity and ammonia concentration. For the sulfate formation two pathways have been identified: One pathway is the radiation induced homogeneous SO/sub 2/-oxidation, yielding sulfuric acid. The second pathway is probably a heterogeneous sulfate formation mechanism in aerosol droplets. The efficiency of this mechanism depends on relative humidity, ammonia concentration and dose. Nitrate and ammonium concentrations in the aerosol depend also on dose and relative humidity. At higher ammonia-stoichiometry a saturation of the nitrate and ammonium concentrations indicates that reduction of NO/sub x/ becomes important.

4419 (KFK-PEF—35-Vol.2, pp 755-767) **Simultaneous flue gas cleaning (desulfurization, denitrification) by means of electron beam irradiation.** Wittig, S.; Spiegel, G.; Platzer, K.H.; Willibald, U. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Thermische Stroemungsmaschinen). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

In the first part of the work presented here, a chemical reaction model describing the process characteristics is introduced and verified by experimental results. Furthermore, model experiments to clarify the reaction of SO/sub 2/ with NH/sub 3/ without irradiation are discussed. Fundamental rules concerning the interaction between flue gas flow and radiation field are derived and validated experimentally. In addition, process modifications such as multiple irradiation and wet scrubbing have been investigated and the experimental results are reported. The transfer from the model experiments to large scale power plants is of dominant importance.

4420 (KFK-PEF—35-Vol.2, pp 769-778) **Denitrification and desulfurization of flue gas by corona discharge.** Scheuermann, A.; Bloss, W.H. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Physikalische Elektronik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Gas discharges can initiate plasmachemical reactions by formation of reactive species, converting the noxious gases NO/sub x/ and SO/sub 2/ into compounds, which can be precipitated (oxidation to corresponding acids, conversion to ammonium salts by addition of NH/sub 3/). Experiments with dc-corona discharge showed the oxidation of NO/sub x/ and SO/sub 2/ requiring high energy input for high conversion percentages. A new pulsed discharge device was realized to increase the efficiency, with isolating sheets separating the gas and the electrodes. When fast rising high voltage pulses are applied to a suitable electrode arrangement, discharges occur, which are distributed homogeneously over the whole gas volume. First results show a higher efficiency for the conversion of NO to NO/sub 2/ compared to the dc-corona discharge. Further improvements are expected by optimization of the discharge device and by addition of NH/sub 3/.

4421 (KFK-PEF—35-Vol.2, pp 779-790) **Development of technical and economical strategies for emission reduction measures for sulphur dioxide, nitrogen oxides, particulates and volatile organic compounds for the sectors energy conversion, industry, traffic, tertiary and domestic in member countries of the European Community.** Rentz, O.; Haasis, H.D.; Morgenstern, T.; Remmers, J.; Schons, G. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Industriebetriebslehre und Industrielle Produktion). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The aim of this project is to determine and analyse emission reduction strategies for sulphur dioxide, nitrogen oxides, particulates and volatile organic compounds. Recommendations for future energy and environmental policies will be developed. Therefore a dynamic linear optimization model will be enhanced by an environmental module. The model will be applied for member countries of the European Community.

4422 (KFK-PEF—35-Vol.2, pp 791-803) **Cost-effectiveness-analysis of strategies to reduce SO/sub 2/- and NO/sub x/-emissions in Baden-Wuerttemberg considering regional aspects.** Mattis, M.; Boysen, B.; Friedrich, R.; Voss, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The objective of this project is to evaluate costs and effectiveness of measures to reduce SO/sub 2/- and NO/sub x/-emissions from all airpolluters in Baden-Wuerttemberg in the context of regional aspects. In a first step the actual SO/sub 2/- and NO/sub x/-emissions in Baden-Wuerttemberg are calculated for each of its 44 countries. In addition a scenario is developed, in order to capture the effects of already implemented as well as planned emission - reduction measures on basis of expected future fuel use. In the next step the effects of further reduction measures are calculated together with the cost component involved. With this conclusions strategies and recommendations for a cost-effective-air-pollution-control policy are developed.

4423 (KFK-PEF—35-Vol.2, pp 805-816) **Evaluation of instruments for realising efficient measures for emission control.** Friedrich, R.; Mattis, M.; Voss, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Different approaches to environmental protection such as standards, charges, marketable permits, subsidies, offset policies and voluntary agreements will be investigated with regard to their efficiency, that means the ability to lower the emission with the least costs possible. Using scenarios of the future development of the SO/sub 2/- and NO/sub x/-emissions in Baden-Wuerttemberg, the effects of different instruments are evaluated. Costs and reductions of emissions are evaluated and compared. Other criteria such as rapidity and degree of realization, costs for administration, economic consequences etc. are also used for the evaluation.

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REFER ALSO TO CITATION(S) 4549, 5249

4424 **(CESI—86-7) Insulation requirements of HVDC systems with particular reference to external insulation performance and relevant research and laboratory tests.** Carrara, G.; Testi, G. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Apr 1986. 12p. (CONF-8604405—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770044/JAW.

From FURNAS HVDC seminar; Rio de Janeiro, Brazil (8 Apr 1986).

The paper, while reviewing the more important aspects of HVDC insulating conditions, mainly focuses on the problems of external DC insulation in polluted conditions. The different causes of failure which are discussed are: thermal runaway, electrolytic effects inside the material and local increase of the electric field inside the material. The paper provides procedures for DC pollution tests at service voltage and reports results of pollution tests with composite voltages. A review is made of research in this areas with the relevant test facilities.

4425 **(CESI—86-20) Composite insulators: progress report on ENEL's (Italian Electricity Board) research.** Marrone, G.; Fini, G.P.; Gallucci, F. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). 1986. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770038/JAW.

The paper reports on accelerated aging tests (electrical, environmental and mechanical types) for composite insulators in EHV systems. These researches have been carried out both on operational lines or at experimental stations and in laboratories. They were aimed at determining long term characteristics and service life expectancy. In particular, the electrical-environmental aging tests have reproduced some features of housing deterioration, while the mechanical aging tests have provided further knowledge on brittle fracture on the core. A wide range of insulators with different types of housing materials were involved in the investigations.

4426 **(CESI—87-2) Planning against voltage collapse.** Falck Christensen, J.; Grainger, A.W.; Santagostino, G.; Stubbe, M.; Verseille, J. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Oct 1986. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770034/JAW.

Several systems have experienced voltage collapse, and questionnaires have indicated a need for a widely accepted procedure for dealing with the voltage collapse problem in system planning. The object of this report is to present a procedure and to establish guidelines for use by system planners in order to prevent voltage collapse. The report contains an explanation of the voltage collapse problem, and how it is influenced by transmission system characteristics, the steady-state and the dynamic behaviour of the load, as well as, the overall system control. Experiences from actual system disturbances are examined together with conclusions from the questionnaire. Prefault conditions are discussed, and it is suggested that the use of use n-2 security in reactive planning could be justified in order to obtain a probability of failure due to voltage collapse consistent with normal practice regarding transient stability. A planning procedure based on a normal load flow program is established, and practical guidelines for planners are drawn up.

4427 **(CESI—87-3) HVAC insulators: clean fog test.** Lambeth, P.J.; Schneider, H.M.; Marrone, G.; Perin, D. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Nov 1986. 10p. (CONF-870203—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770032/JAW.

From Institute of Electrical and Electronic Engineers/ Power Engineering Society winter meeting; New Orleans, LA, USA (1 Feb 1987).

The results of a program of clean fog tests carried out in a number of laboratories on artificially contaminated insulators are reported and analyzed. The effects of fog generation characteristics, insulator coating variability and calculation method are considered. The analysis shows that a high level of reproducibility can be achieved. Requirements are given for ensuring that the reproducibility and repeatability of the method are adequate for its acceptance as a standard testing procedure.

4428 **(CESI—87-4) Failure of transmission line cap and pin insulators under DC stresses.** Peixoto, C.A.O.; Marrone, G.; Carrara, G; Pargamin, L. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Jun 1986. 7p. (CONF-860964—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770033/JAW.

From IEEE/PES transmission and distribution conference and exposition; Anaheim, CA, USA (14 Sep 1986).

The available statistics of the failure rates of transmission line ceramic cap and pin insulators due to self-shattering in most of the HVDC operating lines, indicate an unacceptable high value. This paper discusses these statistics and the possible primary causes for the high failure rate. It describes some of the researches carried out, as well as, the major results obtained. In the conclusions, some indication is given as to means to improve the quality of insulators for DC application and areas for further research work.

4429 **(CESI—87-5) EDELCA 765 kV system (Venezuela) field tests: measurements of switching transients.** Aldrovandi, G.; Carubelli, C.; Furioli, G.; Aquino, Z.; Gavidia, I.J.; Millan, M. (Centro Elecctrotecnico Sperimentale Italiano, Milan). May 1987. 8p. (CONF-8705345—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770037/JAW.

From CIGRE symposium on new and improved materials for electrotechnology; Vienna, Austria (5 May 1987).

The paper describes the measuring system, the measuring problems encountered, and the solutions adopted in the field, during an extensive program of field tests performed for the commissioning of the Edelca 765 kV system. The measured quantities were the overvoltages to earth and across contacts, as well as the phase currents of the circuit breaker during the switching of no load lines, of unloaded transformers and of compensating reactors. The measurements were performed in the presence of the surge arresters, both conventional and zinc-oxide, foreseen for service operation. Some typical examples of the results obtained are also presented.

4430 **(CESI—87-18) Dust chamber for artificail field test conditions for electrical insulators.** Marrone, G.; Marinoni, F.; Gallucci, F. (Ente Nazionale per l'Energia Elettrica, Milan (Italy); Centro Elecctrotecnico Sperimentale Italiano, Milan). May 1987. 5p. (CONF-870826—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770081/ JAW.

From 5. international symposium on high voltage engineering; Braunschweig, F.R. Germany (24 Aug 1987).

A contamination method using a dust chamber was investigated by ENEL (Italian Electricity Board) at a CESI laboratory. The aim was to reproduce, in a conservative way, the mechanism of in-service pollution accumulation on insulators. Thispaper describes the setting up and the operating conditions of the dust chamber and discusses the results of a first series of tests.

4431 **(CESI—87-63) Indoor post insulators of organic material for MV systems: performance testing.** Fini, G.P.; Marrone, G.; Malaguti, C.; Palin, O.; Gallucci, F.; Pigini, A. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Nov 1987. 9p. (CONF-8711244—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770036/JAW.

From 9. meeting on electrical transmission and distribution; Ixtapa, Mexico (1 Nov 1987).

This paper presents results of field experience regarding post insulators made of organic materials for indoor use in MV systems. The experience indicated that the insulators can deteriorate in service. In this respect, visual inspection resulted a useful tool for establishing the insulator condition and showed a good correlation with the electrical performance of insulators. Furthermore the paper presents the parallel laboratory research to study degradation phenomena. An aging test was set up by ENEL (Italian Electricity Board), with particular attention given to the analysis of the degradation of the insulator surface. Similar degradations were obtained on laboratory aged insulators and on those removed from service. The influ-

ence of internal defects on expected life was also studied through proper long duration tests. It was shown that defects detectable by partial discharge at voltage levels higher than the service voltage do not seem especially harmful. The research carried out and the test specifications developed should result in higher reliability in the use of the insulators under examination.

4432 **(CONF-8505393—1) Advance dispatch procedures for the centralized control of real power.** Innorta, M.; Marannino, P. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). May 1986. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770076/JAW.

From IEEE power industry computer application conference; San Francisco, CA, USA (6 May 1985).

In the system control hierarchy, an Advance Dispatching (AD) activity is added between day before scheduling and on-line Economic Dispatch (ED). AD is a useful tool for improving the system operation before the availability of a closed-loop ED and for supplying security constrained participation factors to the regulating units when ED is operating. AD modifies day before scheduling by supplying the optimal trajectories of the thermal units over very short time periods by taking into account the load predictions (30 minutes ahead) and the actual security constraints which include dynamic limitations upon the rates of change of thermal generator MW outputs. For real-time environment, appropriate simplifications have been introduced to the optimal control problem which is a result of the dynamic dispatch formulation. Although accuracy in critical network security constraints and in active losses representation is still provided for, the adoption of a parametric linear programming algorithm in the AD procedure provided a very fast and adequate solution to the problem. The simulation tests on the ENEL (Italian Electricity Board) system clearly pointout the improvements in the AD performances obtained by the inclusion of a second order model of transmission losses. Finally, the economical benefits expected in the real time operation, by adhering to the target supplied by AD, are accounted for.

4433 **(CONF-8604407—1) Power generation, transmission and distribution control: the economic operation of the Italian electric system.** Mocenigo, M.; Sapora, D. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Feb 1987. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770056/JAW.

From Arab seminar on energy rationalization within electric grids; Baghdad, Iraq (7 Apr 1986).

The main goal of A.C. power generation, transmission and distribution control is to supply the requested electric energy with the best level of voltage, continuity of sevice and minimum fuel consumption. Long, medium and short term scheduling is essential for economic and secure operation. The principles for the utilization of different available resources in a complex production system, including conventional, nuclear and hydroelectric power generation, are described, with particular reference to their economical benefits. The amount of information necessary to control the behaviour of power generation, transmission and distribution makes the use of an integrated computer system mandatory.

4434 **(CONF-8608233—1) Conventional and actual load losses in HVDC transformers.** Arturi, C.M; Crepaz, S.; Bossi, A.; Caprio, G.; Babare, A.; Calabro', S.; Coppadoro, F. (Army Materials Research Agency, Watertown, MA (USA). Materials Engineering Div.). Aug 1986. 12p. NTIS (US Sales Only), PC A03. Order Number DE89770050/JAW.

From International conference on large high voltage electric systems; Paris, France (27 Aug 1986).

Conventional load losses in HVDC transformers are determined from the results of a short-circuit test carried out with sinusoidal current. The losses, calculated in this manner, are based on a current r.m.s. value greater than the real one, and lower additional losses, as the effect of harmonics are neglected. In spite of the opposite consequences of these phenomena, the total error may be considerable. Therfore, for a better evaluation of conventional losses, the availability of a more accurate method for testing would be advisable. This paper deals with the problem of the evaluation of the additional losses, and in particular, with those in the operation with a converter. On the basis of theoretical considerations, which have also been checked experimentally, a method for the calculation of the load losses in an operating rectifier transformer is proposed. These losses are only a function of the results of traditional tests such as D.C.resistance measurements and short circuit tests at main frequency, and of the rated operating conditions of the converter, expressed by the value of the direct current, the phase control angle and commutation angle.

4435 **(CONF-8608233—2) Composite insulators for overhead lines: field experience and laboratory research.** Houlgate, R.G.; Swift, D.A.; Cimador, A.; Pourbaix, F.; Marrone, G.; Nicolini, P. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Jan 1986. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770063/JAW.

From International conference on large high voltage electric systems; Paris, France (27 Aug 1986).

In England, France and Italy, recent investigations have been made on composite insulators of many different types. The findings relate to experience on operational lines, tests in outdoor stations and research in the laboratory. Such tests were mainly aimed at determining both the long-term characteristics and the service-life expectancy. The differences in the investigations of the three national utilities, as well as their principal common results and conclusions, are presented. Over the last few years, improvements have occurred in the design and construction of composite insulators. However, some mechanism of failure and degradation are still not well understood.

4436 **(CONF-8608233—4) Analytical methods for evaluating power system transfer capability: a probabilistic approach.** Facchinei, I.; Nevaloro, S.; Nicola, G.; Scalcino, S. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Aug 1986. 5p. NTIS (US Sales Only), PC A02. Order Number DE89770068/JAW.

From International conference on large high voltage electric systems; Paris, France (27 Aug 1986).

In power systems incorporating a variety of generating units with different production costs, it is extremely important for the network not to limit the optimum economic dispatching of the units, even for a few hours in the year. Therefore, at the planning stage, the network transfer capability must be verified in a variety of possible situations, corresponding to various load levels and to various outage conditions. The paper describes how this can be accomplished, by the use of a digital program that simulates (Monte Carlo method) the annual system operation on an hour-by-hour basis, taking into account component outages and economic dispatching. The critical cases - e.g. power flows in excess of line capability - identified by the program, will then be examined in more detail by the programs for network studies (a.c. load flow, stability, etc.) in order to define the actions that are required to ensure correct operation, both in steady state and in transient conditions. The decision of network reinforcements is taken on the basis of an economic comparison between the increase in capital charges and the expected variations, evaluated in probabilistic terms, of running costs and of risk costs.

4437 **(CONF-8609450—1) Optical fiber telecommunication systems on the ENEL's high voltage lines.** Cortina, R.; Nicolini, P.; Schiavi, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Oct 1986. 9p. (In Italian). NTIS (US Sales Only), PC A02. Order Number DE89770040/JAW.

From 87. meeting of the Italian Electrotechnical Association; Florence, Italy (29 Sep 1986).

The paper analyzes the technical and economical aspects of different solutions for an optical fiber telecommunication system installed on ENEL's (Italian Electricity Board) high voltage transmission lines. The progress of the TESEO Project, relative to the solution in which optic fibers are incorporated within guard cables, is also reported.

4438 **(CONF-8708291—1) Research on biological effects of power frequency fields.** Bonnel, J.A.; Maddock, B.J.; Male, J.C.; Norris, W.T.; Cabanes, J.; Gary, C.; Conti, R.; Nicolini, P.; Margonato, V. Vecsteinas, A. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Aug 1986. 9p. NTIS (US Sales Only), PC A02. Order Number DE89770048/JAW.

From International conference on large high voltage electric systems; Paris, France (27 Aug 1987).

For six years now, the Electricity Boards of England, France and Italy (CEGB, EDF and ENEL) have formed a tripartite working group for the research on field effects conducted by each of the three organizations. This report describes the main results of the research programmes and gives brief information on new studies initiated. The research carried out by the three parties is mutually complementary; it includes experiments with animals, as well as, studies with humans and research into the operation of pacemakers. The main conclusion that can be drawn is that power frequency fields reveal no harmful biological effects. When some changes of bio-physiological parameters are observed, they may be due to direct perception of the field.

4439 **(EPRI-EL—6079) Study of improved load-tap-changing for transformers and phase-angle regulators: Final report.** Wood, P.; Bapat, V.; Putkovich, R.P. (Electric Power Research Inst., Palo Alto, CA (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA). Power Electronics Dept.). Nov 1988. 140p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002749/JAW.

The feasibility of using solid-state switches in tap-changing transformers has been investigated and the application of high-speed tap changers as phase angle regulators in transmission and distribution systems has been examined. This study shows that it is not feasible to utilize solid-state switches as "one-for-one" replacements for mechanical tap-changing switches due to prohibitively high costs. Novel transformer winding and solid-state switch configurations have been identified which are, however, economically attractive. Costs and losses associated with various configurations have been calculated for system voltages ranging from 65 to 740 kV. The application of this type of tap change as a fast phase shifter for transmission line applications appears attractive. Limited system simulation studies have been performed to verify that a fast phase shifter of this type can improve transient stability, power oscillation damping and circulating power control. 23 figs., 6 tabs.

4440 **(NP—9770074) Salt-fog tests and low resistivity rain tests on new and aged units of composite insulators.** Fini, G.P.; Marrone, G.; Gallucci, F.; Reali, R. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). May 1987. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770074/JAW.

This paper reports test results obtained with two procedures, salt-fog and rain with low resistivity, on composite insulators for 145 kV overhead lines, made by various manufacturers. The investigation was performed by ENEL (Italian Electricity Board) at a CESI laboratory. In the first procedure, each unit was exposed to a test salinity of 80 kg/cubic meter and the flashover voltage was determined by means of the rapid method. In the second procedure, limited to few insulator types, each unit was submitted to a rain, whose resistivity was varied in the range 0.1-100 micrometers and the flashover voltage was determined by means of an up and down type method. In both procedures, tests were carried out for each insulator type, the investigation included units aged in field, and removed after three years service experience in severe ambient conditions. The aim of the research was to ascertain if a test procedure of relatively short duration could be set up to evaluate the reduction in surface wear resistance of composite insulators, once aged in service or through laboratory tests.

4441 **(NRC/EE—NRCC27685) Bulletin of the Division of Electrical Engineering, 1986-1987.** (National Research Council of Canada, Ottawa, Ontario. Div. of Electrical Engineering). May 1987. 236p. (MICROLOG—88-04457). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Research currently undertaken by the National Research Council of Canada's Division of Electrical Engineering are described in this report. Activities are carried out by the Industrial Liaison Office, which facilitates interactions with the private sector; the Laboratory for Biomedical Engineering, which conducts investigation in the areas of habilitation/rehabilitation engineering, nonionizing radiation effects, and biological information enhancement; the Laboratory for Electromagnetic and Power Engineering, which includes work on industrial microwave applications, precipitation radar and propagation studies, antenna design and development, and eletromagnetic capability; and the Laboratory for Intelligent Systems, whose fields of research cover computing technology, information technology, photonics and sensors, and robotics and automation. Lists of papers and publications are included.

4442 **(SAND—87-7024) Investigation of potential islanding of dispersed photovoltaic systems.** Jones, R.A.; Sims, T.R.; Imece, A. (Sandia National Labs., Albuquerque, NM (USA); Southern Electric International, Birmingham, AL (USA); Auburn Univ., Montgomery, AL (USA)). Oct 1988. Contract AC04-76DP00789. 317p. NTIS, PC A14/MF A01. Order Number DE89002827/JAW.

Photovoltaic sources feed power back to a utility through static power converters (SPCs) during normal operation. The SPCs are designed to shut down when the utility grid is abnormal; however, it has been shown that they continue to operate or "run-on" under certain abnormal conditions. This research was designed to establish the conditions of load vs generation under which run-on would occur. Computer simulations were made of a TESLACO self-commutated SPC and of a Gemini line-commutated SPC. The results of the simulations were verified by laboratory and field tests. Run-on was found to occur only when there was a very close match between PV generation (SPC output) and connected load. For the TESLACO, under matched-load conditions, run-on was limited to 4 seconds, due to destabilizing circuits and internal trip mechanisms. For the Gemini, external VAR support, necessary for matched-load conditions, allows the unit to run-on indefinitely. The addition of internal trip mechanisms based on sensing frequency and voltage, available from the Gemini manufacturer, reduced run-on to an extremely low probability event. The research did not reveal any dynamic interaction among multiple TESLACOs, multiple Geminis, or among TESLACOs and Geminis within an island that would cause the island to persist longer than it would for a single SPC. 29 refs., 117 figs.

21 NUCLEAR POWER PLANTS

4443 **(CONF-880899—5) A new approach to hierarchical decomposition of large-scale systems.** Brittain, C.R.; Otaduy, P.J.; Rovere, L.A.; Perez, R.B. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01. Order Number DE89002350/JAW.

From IEEE international symposium on intelligent control; Arlington, VA, USA (24 Aug 1988).

Several techniques have been proposed for control of large-scale systems (LSSs) by decomposing them into a hierarchy of coordinators and subsystems. A disadvantage common to those methods is that they require iterative solution of the coordinator and subsystem controller equations. The technique presented in this paper results in a noniterative scheme for near-optimal control of both linear and nonlinear large-scale systems. In this approach, the role of the coordinator module is that of a supervisory controller whose task is to establish the strategy for distributing the overall system demands among each of the subsystems according to their performance and plant status. Each subsystem's controller relies on

optimal control algorithms based on uncertain dynamics methods. The solution to each subsystem's optimal control problem is based on Pontryagin's Maximum Principle and the time reversal paradigm for free terminal-time problems. This approach transforms the two-point boundary value problem into an initial value problem, which permits integration of both the state and adjoint equations forward in time. Results obtained on the application of the technique to the power system originally discussed shows good agreement between the decomposed controller and the corresponding centralized optimal controller. In addition, each of the two subsystems' controllers synthesized correctly the dynamics of the two coupling state variables whose contribution to the subsystem model equations was replaced with unknown terms. 5 refs., 6 figs.

4444 **(NUREG—1214-Rev.4) Historical data summary of the systematic assessment of licensee performance.** Allenspach, F. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Licensee Performance and Quality Evaluation). Oct 1988. 76p. NTIS, PC A05/MF A01 - GPO. Order Number TI89003234/JAW.

The Historical Data Summary of the Systematic Assessment of Licensee Performance (SALP) is produced periodically by the US Nuclear Regulatory Commission. This summary provides the results of the assessment for each facility by NRC region and is further divided into the following sections: Section 1 presents the most recent SALP report ratings for facilities in operation and under construction. Section 1 ratings for reactors in operation is subdivided into two parts. The first part is summary data based on prerevised Manual Chapter 0516 functional areas. The second part is summary data based on the revised Manual Chapter 0516 functional areas. Section 2 presents a chronological listing of all SALP report ratings for each operating facility. Section 2 ratings for reactors in operation is also divided into two parts, with the first part based on the prerevised Manual Chapter 0516 and the second part based on the revised Manual Chapter 0516 functional areas. Section 3 presents a chronological listing of all SALP report ratings for each facility under construction. For historical purposes, past construction ratings for facilities that recently have been licensed also are listed in Section 3.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 4454, 4478, 4498, 4510, 4512, 4513, 4519, 4523, 4524, 4525, 4527, 4528, 4536, 4538, 4539, 4543

4445 **(DOE/NE/37965—1) Application of artificial intelligence to the operation of nuclear power plants: Final report for the period September 22, 1986--May 31, 1988.** Hajek, B.K. (Ohio State Univ. Research Foundation, Columbus (USA)). Sep 1988. Contract AC02-86NE37965. 46p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003030/JAW.

Using the Generic Task approach, an Operator Advisor for use in nuclear power plant control rooms has been developed in prototype form. This research expanded upon earlier research during which two separate prototype systems had been developed. One was a diagnostic system that detected plant abnormal conditions and identified the root cause of the malfunction. The other was a system to synthesize a procedure for the operator to follow when an abnormal event occurred. This document discusses activities performed during this reporting period.

4446 **(EPRI—9003532) Advanced light water reactor requirements document: Chapter 6: Building design and arrangement: Revision 0.** (Electric Power Research Inst., Palo Alto, CA (USA); Bechtel Power Corp., San Francisco, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA); Duke Power Co., Charlotte, NC (USA); General Electric Co., San Jose, CA (USA); MPR Associates, Inc., Washington, DC (USA); Levy (S.), Inc., Campbell, CA (USA); Sargent and Lundy, Chicago, IL (USA); Stone and Webster Engineering Corp., Boston, MA (USA); Westinghouse Electric Corp., Monroeville, PA (USA); Yankee Atomic Electric Co., Framingham, MA (USA)). Nov 1988. 232p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003532/JAW.

The purpose of the Advanced LWR Plant Requirements Document is to define utility requirements for the building design and equipment arrangement of LWR plants, which incorporate the lessons learned from the evolution of LWR technology as applied to the generation of electricity, and to take advantage of that experience with the goals of improving safety, reliability, and operability at reduced overall power generation cost. The requirements in this revision of Chapter 6 are primarily those applicable to ALWRs of an evolutionary design. The general arrangement sketches which are included in Appendixes C and D are based on the evolutionary plant concept (designed to meet requirements described in this and other chapters of the ALWR Requirements Document).

4447 **(NUREG/CR—5248) Prioritization of TIRGALEX [Technical Integration Review Group for Aging and Life Extension]: Recommended components for further aging research.** Levy, I.S.; Wreathall, J.; DeMoss, G.; Wolford, A.; Collins, E.P.; Jarrell, D.B. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Pacific Northwest Lab., Richland, WA (USA); Science Applications International Corp., Columbus, OH (USA)). Nov 1988. Contract AC06-76RL01830. 206p. (PNL—6701). NTIS, PC A10/MF A01 - GPO. Order Number TI89002949/JAW.

The "Plan for Integration of Aging and Life Extension," developed by Technical Integration Review Group for Aging and Life Extension (TIRGALEX) in May 1987, identified the safety-related nuclear power plant structures and components (S/C) that should be prioritized for further evaluation by the NRC's Nuclear Plant Aging Research Program (NPAR). This report documents the results of an expert panel workshop established to perform the S/C prioritization activity. Prioritization was primarily based upon criteria derived from a specially-developed risk-based methodology. This methodology incorporates the effect upon plant risk of both component aging and the effectiveness of current industry aging management practices in mitigating that aging. An additional set of criteria used to categorize the S/C is the importance of aging research on S/Cs to the resolution of generic safety issues (GSI) and/or to identified NRC/NRR user needs. The resultant S/C categorization was to provide additional information to decision makers, but was not used to calculate final S/C ranks. 15 refs., 5 figs., 16 tabs.

4448 **(PNL-SA—16049) LWR spent fuel radiochemical measurements and comparison with ORIGEN2 predictions.** Blahnik, D.E.; Jemquin, U.P.; Guenther, R.J. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1988. Contract AC06-76RL01830. 7p. (CONF-881011—31). NTIS, PC A02/MF A01. Order Number DE89003138/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The Materials Characterization Center (MCC) at Pacific Northwest Laboratory (PNL) is responsible for providing characterized spent fuel, designated Approved Testing Materials (ATMs), for subsequent use in the investigation of nuclear waste disposal forms by the US Department of Energy geologic repository project. The ATMs are selected to assure that test material is available that has a representative range of characteristics important to spent fuel behavior in a geologic repository. Burnup and fission gas release were the primary criteria for selecting the ATMs. The five spent fuel ATMs (ATM-101, -103, -104, -105, and -106) currently

being characterized by the MCC have rod average burnups ranging from 28 MWd/kgM to 43 MWd/kgM, fission gas releases ranging from 0.2% to 11.2%, and are from both boiling water reactors and pressurized water reactors. 8 refs., 2 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 4231, 4234, 4445, 4446, 4447, 4448, 4478, 4483, 4496, 4498, 4508, 4509, 4519, 4521, 4522, 4523, 4524, 4525, 4526, 4527, 4528, 4530, 4531, 4532, 4533, 4536, 4538, 4539, 4540, 4541, 4543, 4708, 5369, 5370, 5371

4449 (ACIESP—60-Vol.4, pp 325) **Environmental monitoring at Angra site.** 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

4450 **(BNL-NUREG—41751) Progress in understanding of direct containment heating phenomena in pressurized light water reactors.** Ginsberg, T.; Tutu, N.K. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 12p. (CONF-881115—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001102/JAW.

From 3. international topical meeting on nuclear power plant thermal hydraulics and operations; Seoul, Korea (14 Nov 1988).

Progress is described in development of a mechanistic understanding of direct containment heating phemonena arising during high-pressure melt ejection accidents in pressurized water reactor systems. The experimental data base is discussed which forms the basis for current assessments of containment pressure response using current lumped-parameter containment analysis methods. The deficiencies in available methods and supporting data base required to describe major phenomena occurring in the reactor cavity, intermediate subcompartments and containment dome are highlighted. Code calculation results presented in the literature are cited which demonstrate that the progress in understanding of DCH phenomena has also resulted in current predictions of containment pressure loadings which are significantly lower than are predicted by idealized, thermodynamic equilibrium calculations. Current methods are, nonetheless, still predicting containment-threatening loadings for large participating melt masses under high-pressure ejection conditions. Recommendations for future research are discussed. 36 refs., 5 figs., 1 tab.

4451 **(CEA-N—2563) Simplified formalism for the pressurised water reactor residual heat calculation in terms of the main running parameters.** Temperville, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). Jun 1988. 58p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755992/JAW.

The available power, after nuclear reactor stop, called residual heat, is a significant parameter for reactor safety and irradiated fuel handling. In this work we developed a calculation method to obtain, in a fast simplified manner, this residual heat. In this method, an approximation allowing us to treat separately the phenomena due to neutron capture and nuclide decay was used. An interactive computer code was written. This technique was applied to the decay heat calculation of a french 900 MWE pressurized water reactor, loaded with 3.25% U235 enriched fuel. The application was made for decaying times between 1 second and 30 years. Specific library was created. Comparison with results given by the exact computer code showed that the approximation was entirely justified for the chosen application.

4452 **(CONF-8609451—3) Analysis of a PWR steam generator control system.** Bittanti, S.; Cori, R.; Pretolani, F. (Politecnico di Milano (Italy). Dipt. di Elettronica). Jun 1986. 6p. NTIS (US Sales Only), PC A02. Order Number DE89770078/JAW.

From 2. IFAC workshop on modelling and control of electric power plants; Philadelphia, PA, USA (1 Sep 1986).

In this paper, some dynamical models for a PWR steam generator are proposed. The main dynamical behaviours of the components are studied by means of a simple qualitative nonlinear model. Then, three linearized models, corresponding to 10%, 50% and 100% loads, are properly identified. On the basis of these models, some control schemes, including the classical one, are analyzed.

4453 **(EUR—11374) Post-test calculations of aerosol behavior in DEMONA experiment B3 with various computer codes used in CEC member states.** Schoeck, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (DE)). (Commission of the European Communities, Luxembourg). 1988. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756010/JAW.

Extensive research has been carried out around the world to understand the behavior of radioactive materials in the containment building of an LWR under accident conditions. Most of this material is in the form of aerosols or is attached to non-radioactive aerosol particles in the containment atmosphere. Several computer codes have been written to describe fission product aerosol behavior under accident conditions, aimed at evaluating the time dependent airborne concentration inside the reactor building and the fraction that leaks out to the environment. The objective of this Study was to perform a comparison of computer codes used in the CEC member states with a DEMONA experiment. This is a follow up study to an earlier exercise comparing codes to each other in which rigid benchmark cases of more or less artificially detailed nature had been used. In the present Study the comparison to the DEMONA experiment was to be oriented only at the experimental results without additional help provided. It should thus provide a basis for judging the practical applicability of the codes to a situation which is real but, maybe, less well defined than a theoretical benchmark case.

4454 **(EUR—11387) Fuel performance code future.** Ronchi, C.; Van de Laar, J. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). (Commission of the European Communities, Luxembourg). 1988. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88756013/JAW.

The paper describes the LWR version of the fuel performance code FUTURE, which was recently developed to calculate the fuel response (swelling, cladding deformation, release) to reactor transient conditions, starting from a broad-based description of the processes of major concern. The main physical models assumed are presented together with the scheme of the computer program.

4455 **(INIS-mf—11314) Effect of operating conditions and environment on properties of materials of PWR type nuclear power plant components.** Vacek, M. (Ceskoslovenska Komise pro Atomovou Energii, Prague). Dec 1987. 117p. (In Czech). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704351/JAW.

Normalizace v Jaderne Technice.; (no.3).

Operating reliability and service life of PWR type nuclear power plants are discussed with respect to the material properties of the plant components. The effects of the operating environment on the material properties and the methods of their determination are characterized. Discussed are core materials, such as fuel, its cladding and regulating rod materials, and the materials of pipes, steam generators and condensers. The advances in the production of pressure vessel materials and their degradation during operation are treated in great detail. (Z.M.).

4456 (INIS-mf—11328, pp 63) **Calculation of bursting in fuel rods.** Sdouz, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Energie- und Anlagentechnik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4457 (KFK—4450, pp 243-254) **Verification of calculational methods for light water high converter reactors by critical experiments.** Berger, H.D.; Boehme, R.; Chawla, R. (Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich KWU; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Paul Scherrer Inst., Wuerenlingen (Switzerland)). Jun 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW. (CONF-870424—).

From American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France (27 Apr 1987).

Calculational results relevant to the physics characteristics of PuO/sub 2//UO/sub 2/-fueled light water high converter reactors (LWHCR) are discussed in the context of three particular codes and their associated data libraries, viz. WIMS/D, KARBUS (GRUCAH) and SPEKTRA. Analysis of various critical experiments - from the PROTEUS-LWHCR Phase I and Phase II programmes in particular - has demonstrated the importance of having a representative and comprehensive integral data base for identifying specific shortcomings in the calculational tools employed.

4458 (KFK—4450, pp 271-273) **Test facility NERA for determination of velocity and temperature distribution in subchannels.** Meyer, L.; Mensinger, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

A large scale model of a fuel element rod bundle with 37 rods in a triangular array is under construction. The rods will be electrically heated, the cooling fluid is air. The aim is the measurement of turbulence quantities in heated flow in narrow rod bundles. The technique of a heated rod with a diameter of 140 mm has been successfully developed.

4459 (KFK—4450, pp 274-281) **Investigations in freon on critical heat flux in a APWR (KRISTA-program).** Erbacher, F.J.; Barth, S.; Just, W.; Neitzel, H.J.; Schaeffner, P.; Wiehr, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The test program was discussed and a test matrix established. - The development of the fuel rod simulators is completed. Based on design calculations a heated length of 60 cm was chosen. - The construction of the test loops is completed, the commissioning tests are under way. Computer code systems for Cl+F-detection and data acquisition are developed.

4460 (NUREG—1332) **Regulatory analysis for the resolution of Generic Issue 125.II.7 "Reevaluate Provision to Automatically Isolate Feedwater from Steam Generator During a Line Break".** Basdekas, D.L. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution). Sep 1988. 25p. NTIS, PC A03/MF A01 - GPO. Order Number TI89001458/JAW.

Generic Issue 125.II.7 addresses the concern related to the automatic isolation of auxiliary feedwater (AFW) to a steam generator with a broken steam or feedwater line. This regulatory analysis provides a quantitative assessment of the costs and benefits associated with the removal of the AFW automatic isolation and concludes that no new regulatory requirements are warranted. 21 refs., 7 tabs.

4461 (NUREG/CR—4828) **Fatigue crack growth of part-through cracks in pressure vessel and piping steels: Air environment results.** Cullen, W.H.; Jolles, M.R. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA)). Oct 1988. 42p. (MEA—2198). NTIS, PC A04 - GPO. Order Number TI89003460/JAW.

This report describes the first phase of a program to evaluate the effect of PWR water environment on the fatigue crack growth in part-through surface-crack specimens in pressure vessel and piping steels, unclad and clad. The objective of the program is to compare the crack growth rate data from a two-dimensional crack with that generated from the more popular compact specimens. The results of room air environment tests, at ambient temperature and 288{degree}C are presented. The materials used, the description of the cladding process, the test specimen preparation for the direct current potential drop (DCPD) technique, and the computerized data acquisition systems are described. The computational techniques for the processing of the DCPD data are detailed, and the crack extension plots are presented. The crack growth rate data from these air environment tests are compared with data sets from tests of compact tension specimens in the same orientations as the major and minor axes of the semielliptical part-through crack. 14 refs., 30 figs., 1 tab.

4462 (SKI—87051) **Analysis of breaks in pipe connections to the hot leg and to the loop seal in the primary system of Ringhals 2 PWR.** Nilsson, L.; Sjoeberg, A. (Swedish Nuclear Power Inspectorate, Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). 27 May 1987. 108p. (In Swedish). (STUDSVIK-NP—87-57). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755686/JAW.

Analysis has been made of seven different cases of breaks in pipes connected to the hot leg and to the loop seal in Ringhals 2 PWR. The pipes, in which guillotine breaks are postulated, have nominal diameters ranging from 1 to 14 inches. The purpose of the analysis is to supplement the basis for a review of the inspection procedures for the safety of pressure vessels prescribed by SKI. A similar analysis already exists concerning breaks in the cold leg connections. The analysis has been made using the thermal hydraulic computer code RELAPS/MOD2 and with best estimate assumptions. This means that normal operating conditions have been adopted for the input to the calculations. However, the capacity of the safety injection system was assumed to be reduced by having one pump not operating each of the low pressure and high pressure safety injection system. The results of the analysis are presented in tables and as computer plots. The analysis shows that the consequences with respect to increased fuel rod and cladding temperatures are quite harmless. Only the two cases with the largest break sizes lead to critical heat flux (CHF) and increased temperatures for the hottest rods in the core. The peak cladding temperature was 636 degrees C for the 12 inch break. In both cases rewetting occurred within 25 s of accident initiation. In the cases with breaks in connections of 6 inch diameter and smaller the RELAP5 calculations indicated a substantial margin to CHF throughout the transient. (authors).

4463 (SRD-R—475) **Simple calculations to predict the behaviour of the Sandia 1/6 scale model reinforced concrete containment building.** Harrop, L.P. (UKAEA Safety and Reliability Directorate, Culcheth). Jun 1988. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755488/JAW.

This report presents simple calculations that have been done to predict the behaviour of the Sandia 1/6 scale model reinforced concrete containment building. This model is representative of PWR dry containment buildings used in the USA. Details of the calculations are given in several Appendices, the results are gathered together in the main text. The predictions made from these simple calculations are useful in their own right and will be compared with the actual performance of the model in the test. These predictions are also useful in providing guidance for more detailed analyses using non-linear finite element structural analysis codes. The main prediction of the work presented here is that failure will occur due to circumferential stresses in the cylinder region of the building though the exact mode of failure is not certain. The internal pressure for failure will be in the range 170 to 190 psig (1.17 to 1.31 MPa). Such failure is predicted so long as the test is not prematurely terminated by leakage. It is virtually certain that the model will sustain a pressure greater than twice the design pressure.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 4104

4464 **(CEGB-TPRD/B—1060/R88) Effect of surfaces on AGR coolant chemistry: critical assessment of gas-phase rate constants relevant to ethane pyrolysis.** Gonzales, M.D.U.; Norfolk, D.J. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1988. 51p. (CDMSG/P—88-8). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755474/JAW.

Previous work has shown the ability of a chemical kinetic model, applied using the FACSIMILE computer code, to predict the thermal decomposition of ethane in a silica flow reactor. To optimise the performance of the model, the present report reviews the literature data on the twenty reactions which it incorporates. Critical assessment has shown some discrepancies in the previously used rate constants, especially those leading to ethyne formation. Table 2 of the report gives the kinetic data which, as a result of the present evaluation, are recommended for future work. Use of these data gives significantly improved agreement between the model and the experimental results, particularly for ethyne formation, which had previously been underestimated.

4465 **(DOE/HTGR—88-095) Very-high-temperature reactors for future use.** Kasten, P.R. (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 20p. (ORNL/TM—10805; CONF-880578—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89001149/JAW.

From International symposium on strategy for innovation in materials processing: new challenge for the 21st. century; Osaka, Japan (17 May 1988).

Very-high-temperature reactors (VHTRs) show promise for economic generation of electricity and of high-temperature process heat. The key is the development of high-temperature materials which permit gas turbine VHTRs to generate electricity economically, at reactor coolant temperatures which can be used for fossil fuel conversion processes. 7 refs., 5 figs.

4466 (INIS-SU—58, pp 51-55) **Determination of irregularity of uranium distribution in HTGR fuel elements by gamma absorption method.** Isaenko, V.I.; Kossykh, V.G.; Kulikov, E.T.; Shtauberg, I.F. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Possibilities of the non-destructive gamma-absorption method for determination of irregularity of uranium distribution in a fuel kernel of a HTGR ball fuel element are considered. A way to find the maximum irregularity value for the given fuel element is described. As it is controlled the ball fuel element γ-rays in two positions, and the second position is determined according to the results of measurements in the first one. The error of irregularity determination is characterized by the mean square deviation constituting 1.4% throughout the whole value interval. Control time of one product is o.5 h. 5 refs.; 3 figs.; 2 tabs.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 4507, 4520

4467 **(CEA-CONF—9450) French experience of decontamination of FBRs' components in view of reuse.** Michaille, P.; Msika, D.; Pochitaloff, P. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI); Lambert, I.; Le Guidou, A.; Poupard, M. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 3p. (CONF-881009—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755329/JAW.

From 4. international conference on liquid metal engineering and technology; Avignon, France (17 Oct 1988).

The paper is an overview of the reagents and methods used to decontaminate the French LMFBRs' components, mostly based on the experience of PHENIX. Prior to their use on the plant, the reagents were selected from preliminary tests at the laboratory scale.

4468 **(CEA-DAS—494) Analysis of the sodium concrete interactions with the NABE code.** Soule, N. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Jul 1988. 22p. (CONF-8806200—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755333/JAW.

From International Atomic Energy Authority meeting on sodium fires; Obninsk, USSR (6 Jun 1988).

Experimental studies have been performed in France to investigate sodium-concrete interactions: thermal decomposition of concrete, specific chemical reactions, experimentation in liquid and vapour phase, sodium-concrete interaction without liner protection. Simultaneously computer codes have been developed in order to study the response of the containment building of a liquid metal fast breeder reactor to sodium pool fire worsened by a sodium-concrete interaction: the NABE code. This code takes into account: sodium combustion, thermal decomposition of concrete with associated chemical reactions: (liquid sodium-vapour water reaction, liquid sodium-carbon dioxide reaction, liquid sodium-solid compounds of concrete, hydrogen combustion), chemical reactions in vapour phase, decay heat, gaz aerosol inlets/outlets, aerosol behaviour (sedimentation, diffusion, leak), thermal exchanges. An example of situation, typical of assessment of beyond design basis situations in LMFBR is given.

4469 **(EUR—11270) Review of strain buckling: analysis methods.** Moulin, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques). (Commission of the European Communities, Luxembourg). 1987. 85p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756005/JAW.

This report represents an attempt to review the mechanical analysis methods reported in the literature to account for the specific behaviour that we call buckling under strain. In this report, this expression covers all buckling mechanisms in which the strains imposed play a role, whether they act alone (as in simple buckling under controlled strain), or whether they act with other loadings (primary loading, such as pressure, for example). Attention is focused on the practical problems relevant to LMFBR reactors. The components concerned are distinguished by their high slenderness ratios and by rather high thermal levels, both constant and variable with time. Conventional static buckling analysis methods are not always appropriate for the consideration of buckling under strain. New methods must therefore be developed in certain cases. It is also hoped that this review will facilitate the coding of these analytical methods to aid the constructor in his design task and to identify the areas which merit further investigation.

4470 **(EUR—11364) Conclusive report on the activities of the Containment Expert Group 1975-87.** Balz, W. (Commission of the European Communities, Brussels (Belgium)); Dufresne, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)) (eds). (Commission of the European Communities, Luxembourg). 1988. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88756009/JAW.

The report summarizes the results of the activities of the CONT Expert Group, a subgroup of the CEC Fast Reactor Safety Working Group (SWG). The CONT group's work has over the last 12 years (1975-87) covered a wide spectrum of problems related to the behaviour of the primary containment of a sodium-cooled fast reactor following an accident releasing a large amount of mechanical energy. In particular the CONT group followed closely the code development and validation (COVA) programme carried out at the JRC Ispra. This activity also included an assessment of related material programmes. From a comparison of containment codes and a sensitivity analysis, it was concluded that the codes developed in the EC Member States and at the JRC Ispra allow to treat the consequences of a hypothetical core-disruptive accident on primary containment with adequate accuracy. Consequently the the group considered its mandate fulfilled and terminated its activities.

4471 **(FRNC-TH—3286) Neutronic characteristics simulation of LMFBR of great size.** Kim, Y.C. (Institut National Polytechnique, 38 - Grenoble (France)). Sep 1987. 236p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88756019/JAW.

The CONRAD experimental program to be executed on the critical mockup MASURCA in Cadarache and use all the european plutonium stock. The objectives of this program are to reduce the uncertainties on important project parameters such as the reactivity value of control rods, the flux distribution to valid calcul methods and data to use for new LMFBR conception (heterogeneous axial core by example) and to resolve the neutronic control problems for a LMFBR of great size. The present study has permitted to define this program and its physical characteristics.

4472 **(IEN-DERE-DIFIR—14/87) Determination of homogenization factors in the simulation in the azymuthal flux unit distribution in the control ring of a experimental fast reactor.** Jachic, J. (Instituto de Engenharia Nuclear, Rio de Janeiro (Brazil)). 1987. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704244/JAW.

The azimuthal neutronic flux distribution in the control ring region for a low power fast reactor is simulated using a plate and rectangular smash models for one dimensional calculations under periodic boundary conditions in the frontier. (E.G.).

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 4460, 4490, 4518, 4542

4473 **(EPRI-NP—5653-Vol.2) Guidelines for the content of records to support nuclear power plant operation, maintenance, and modification (NCIG-08): Volume 2, Appendixes A, B, and C: Final report.** Reedy, R.F.; Hegglin, D.P. (Electric Power Research Inst., Palo Alto, CA (USA); Reedy Associates, Inc., Los Gatos, CA (USA)). Nov 1988. 196p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002747/JAW.

The record systems at many nuclear power plant sites are becoming overloaded with unnecessary and superfluous records. The reason for this overload is that although the Codes and Standards list the record types to be retained, there is no definition for the contents of the records. This encourages varied interpretations which often lead to the approach of "save everything". This document provides guidelines for the content of records to support nuclear power plant operation, maintenance and modification. These Guidelines are based on an engineering approach to identify which data in the records are of "significant value" in (1) demonstrating capability for safe operation; (2) maintaining, reworking, repairing, replacing, or modifying an item; (3) determining the cause of an accident or malfunction of an item; and (4) providing required baseline for in-service inspection. Particular topical issues affecting record retention needs, such as plant life extension activities, may require additional evaluation of data or records. By identifying the data to be retained in the records, it is possible to modify the record management system to substantially reduce the amount of unnecessary information being retained in the records. These Guidelines will provide for more uniform interpretation of requirements. This document, Volume 2, contains Appendices A, B and C.

4474 **(INIS-XN—142) Seminar on present and future Spanish Legislation on nuclear energy.** (Consejo de Seguridad Nuclear, Madrid (Spain); Universidad Complutense, Madrid (Spain). Faculty of Law; International Nuclear Law Association (INLA), Brussels (Belgium)). Sep 1986. 120p. (In Spanish, French). (CONF-8609455—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88704933/JAW.

From Seminar on present and future Spanish legislation on nuclear energy; Madrid, Spain (29 Sep 1986).

The Seminar was organized in Madrid by the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear), the Complutense University Law Faculty and the International Nuclear Law Association (INLA).

The Proceedings of the Seminar contain the papers presented and the conclusions of each Session. The topics cover Spanish nuclear legislation including the licensing of nuclear power plants and control, analysed in the context of legislation in other fields and the new requirements since Spain joined the European Communities. Other papers deal with the origin and evolution of Spanish nuclear law, the competent international organizations and the nuclear third party liability regime set in place by the international conventions in that field. Also discussed are the national regulations on radioactive waste management and the competent authorities. Finally, a revision of the Spanish Nuclear Energy Act is considered necessary in the light of developments since its inception.

4475 **(NUREG—0540-Vol.10-No.8) Title list of documents made publicly available, August 1--31, 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Nov 1988. 432p. NTIS, PC A19/MF A01 - GPO. Order Number TI89002951/JAW.

This monthly publication contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the {ital Title List} includes the information formerly issued through the Department of Energy publication {ital Power Reactor Docket Information}, last published in January 1979. Microfiche of the docketed information listed in the {ital Title List} is available for sale on a subscription basis from the National Technical Information Service (NTIS).

4476 **(NUREG—0750-Vol.28-No.3) Nuclear Regulatory Commission issuances, September 1988.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services). Sep 1988. 146p. NTIS, PC A07/MF A01 - GPO. Order Number TI89003232/JAW.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM). The summaries and headnotes preceding the opinions reported herein are not to be deemed a part of those opinions or to have any independent legal significance.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 4457, 4530

4477 (EIR—632) Use of MELANIE. Lanfranchi, M. (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). Sep 1987. 21p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704326/JAW.

MELANIE allows to calculate, with a minimum of simple instructions, the transport of neutrons and gammas in slab, spherical and cylindrical geometry. MELANIE has several libraries of microscopic group cross sections. The preparation of macroscopic cross sections is trivial whatever is number of groups, energy regions, order of developments of Legendre, etc. Geometry and sources are defined through elementary instructions which permit the choice of continuous or discrete spectrum, independently of the group structure. The transport calculation is done by well-known codes, e.g. ANISN and SURCU, for which MELANIE manages the input and output. Input to MELANIE is elementary because the code defines, instead of the user, the best choice of parameters and appropriate options. Adequate commands permit to modify them if necessary. MELANIE is enclosed by peripheral programs which permit to obtain information such as fluxes in different energy regions, doses, heat production, etc., in form of tables and graphs. The version MELANIE 7 described here is built in the system RSYST. An independent version is in preparation. MELANIE permits to save time for preparation of input. Its great flexibility of input and output makes it a modern code. 1 ref., 1 tab.

4478 (PSI—13) MCNP analysis of the nine-cell LWR gadolinium benchmark. Arkuszewski, J.J. (Paul Scherrer Institute, Wuerenlingen (Switzerland)). (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). 19 Aug 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704406/JAW.

The Monte Carlo results for a 9-cell fragment of the light water reactor square lattice with a central gadolinium-loaded pin are presented. The calculations are performed with the code MCNP-3A and the ENDF-B/5 library and compared with the results obtained from the BOXER code system and the JEF-1 library. The objective of this exercise is to study the feasibility of BOXER for the analysis of a Gd-loaded LWR lattice in the broader framework of GAP International Benchmark Analysis. A comparison of results indicates that, apart from unavoidable discrepancies originating from different data evaluations, the BOXER code overestimates the multiplication factor by 1.4 % and underestimates the power release in a Gd cell by 4.66 %. It is hoped that further similar studies with use of the JEF-1 library for both BOXER and MCNP will help to isolate and explain these discrepancies in a cleaner way. (author) 4 refs., 9 figs., 10 tabs.

4479 (UJV—8222-R) Methodology of three-dimensional multigroup diffusion program in hexagonal configuration. Kujal, B. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Feb 1988. 23p. (In Czech). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704410/JAW.

The methodology is described of NEHEX-3D code for multigroup diffusion equations in three-dimensional hexagonal geometry. The computer code is based on the nodal approach and transverse integration technique which transforms the original three-dimensional diffusion equation to four one-dimensional differential equations. Three equations correspond to three directions in the hex plane, the fourth corresponds to the axial direction. Onedimensional neutron fluxes are inside the node expanded into polynomials up to the third order. The resulting relations for out-going partial currents are expressed in form of a response matrix equation and they are solved by the fission source iteration method. (author). 2 figs., 3 tabs., 15 refs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 4494, 4535, 4545, 4869

4480 (CEGB-R/M/N—1077) NUMEL: a computer aided design suite for the assessment of the steady state, static/dynamic stability and transient responses of nuclear steam generators. User manual. Rowe, D.; Lightfoot, P. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Feb 1988. 136p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755435/JAW.

Issue B.

NUMEL is a computer aided design suite for the assessment of the steady state, static/dynamic stability and transient responses of nuclear steam generators. The equations solved are those of a monotube coflow or counterflow heat exchanger. The advantages of NUMEL are its fast execution speed, robustness, extensive validation and flexibility coupled with ease of use. The code can simultaneously model up to four separate sections (e.g. reheater, HP boiler). This document is a user manual and describes in detail the running of the NUMEL suite. In addition, a discussion is presented of the necessary approximations involved in representing a serpentine or helical AGR boiler as a monotube counterflow heat exchanger. To date, NUMEL has been applied to the modelling of AGR, Fast Reactor and once through Magnox and conventional boilers. Other versions of the code are available for specialist applications, e.g. Magnox and conventional recirculation boilers.

4481 (CEGB-RD/M—1693/RR88) Full size validation of remanent life assessment methods. Hepworth, J.K.; Williams, J.A. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.). Mar 1988. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755469/JAW.

A range of possible life assessment techniques for the remanent life appraisal of creeping structures is available in the published literature. However, due to the safety implications, the true conservatism of such methods cannot be assessed on operating plant. Consequently, the CEGB set up a four vessel programme in the Pressure Vessel Test Facility at the Marchwood Engineering Laboratories of the CEGB to underwrite and quantify the accuracy of these methods. The application of two non-destructive methods, namely strain monitoring and hardness measurement, to the data generated during about 12,000 hours of testing is examined. The current state of development of these methods is reviewed. Finally, the future CEGB programme relating to these vessels is discussed.

4482 (CEGB-TPRD/B—0938/R87) Supercell comparisons between LWRWIMS and AKTS. Part 2. Radial reflector representation. Hutt, P.K.; Nunn, D.L. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1988. 37p. (PKWG/P—87-299). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755470/JAW.

Studies are presented of two supercells both containing a portion of radial reflector, a slab supercell (which is essentially one-dimensional) and a small quadrant having a stepped core reflector edge. The aim of the study is to make recommendations for the derivation of radial reflector data to be used in 2-group nodal reactor calculations. Three ways of deriving smeared reflector data from a slab supercell are proposed. These all give exact results for the one-dimensional slab from which they are derived. However, the reflector data derived to preserve albedos are less sensitive to change in the fuel adjacent to the reflector than data formed by a flux-weighted smear. The three sets of reflector data, derived from a slab supercell, all give accurate results when used in the quadrant supercell. However, using a uniform albedo-type boundary condition in the quadrant supercell instead gives poor results even though the boundary conditions are equivalent to the explicit reflector in the one-dimensional case. This study shows that a significant part of the difference between transport and diffusion-derived reflector data, which has previously been ignored, is the difference between edge assembly discontinuity factors.

4483 (CEGB-TPRD/B—0939/R87) Supercell comparisons between LWRWIMS and AKTS. Part 3. The representation of symmetrically poisoned assemblies. Hutt, P.K.; Nunn, D.L. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755471/JAW.

Comparisons are presented of 2-group nodal AKTS and 6-group LWRWIMS/GOG calculations for two supercells containing the two types of asymmetrically poisoned assemblies present in Sizewell B cycle 1. The GOG calculations, regarded as a reference, represent individual fuel and poison pins. The AKTS calculations employ smeared assembly data. For symmetric assemblies such smeared data is usually obtained from single assembly GOG calculations performed with zero leakage boundary conditions. Such an approach for asymmetrically poisoned assemblies gives very inaccurate results. It is proposed to represent such assemblies as split in two halves with different data for each half derived from symmetric single assembly calculations. To represent such split assemblies and retain a coarse noding required an extension of the nodal method. The supercell comparisons reported here verify that such a representation of these assemblies and the extension of the nodal method gives accurate results relative to a reference pin-by-pin calculation.

4484 (CEGB-TPRD/B—1020/R88) Fluid/structure interaction in BERDYNE (Level 4). Fox, M.J.H. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1988. 18p. (SRDM—87/P46). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755472/JAW.

A fluid-structure interaction capability has been developed for Level 4 of the finite element dynamics code BERDYNE, as part of the BERSAFE structural analysis system. This permits analysis of small amplitude free or forced vibration of systems comprising elastic structural components and inviscid volumes of possibly compressible fluid. Free fluid surfaces under the influence of gravity may be present. The formulation chosen uses the rigid walled fluid modes, calculated in a preliminary stage, as a basis for description of the coupled system, providing symmetric system matrices for which efficient solution procedures are available. The inclusion of the fluid modal variables within the system matrices is carried out through the use of the BERDYNE 'substructuring' feature, which allows the inclusion of very general 'super-elements' among the normal structural elements. The program also has a seismic analysis capability, used for the analysis of fluid-structure systems subjected to a specified support acceleration time history. In this case analysis is carried out in terms of relative structural motions, but absolute fluid pressures. Application of the BERDYNE fluid/structure interaction capability to some simple test cases produced results in good agreement with results obtained by analytic or independent numerical techniques. Full instructions on the use of the facility will be included in the BERDYNE Level 4 documentation. Interim documentation for the pre-release version is available from the author.

4485 (CEGB-TPRD/B—1053/R88) Tribology aspects of a pressure vessel closure subjected to pressure cycling. George, A.F.; Williams, M.E. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1988. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755473/JAW.

A repair method being considered for a steel pressure vessel is to cut away the faulty part leaving an unreinforced circular hole in the curved wall and cover it with a sealed plate placed inside. In order to investigate the structural properties of such a repair a large model vessel (6m by 2m) was tested under pressure (about 2.5 MPa) and pressure cycling. This cycling caused relative movements at the loaded interface between the lid and the vessel. A tribological examination of the rubbing surfaces was carried out. The tribological examination is described and a small supporting programme of laboratory scaling tests. It gives the results and attempts to interpret them with particular attention given to wear, fretting fatigue and scaling to plant conditions.

4486 (CONF-8810155—11) Assessment of nonintrusive methods for monitoring the operational readiness of solenoid-operated valves. Kryter, R.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002330/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Solenoid-operated valves (SOVs) are being studied at Oak Ridge National Laboratory as part of the USNRC Nuclear Plant Aging Research (NPAR) Program. The primary objective of the study is to identify and recommend methods for inspection, surveillance, and maintenance of SOVs that can ensure their operational readiness-- that is, their ability to perform required safety functions under all anticipated operating conditions. An earlier (Phase I) study described SOV failure modes and causes and identified measurable parameters that might be used to monitor the various degradations that lead to functional failure. The present (Phase II) study focuses on devising and then demonstrating the effectiveness of techniques and/or equipment with which to measure the previously identified performance parameters and thus detect and trend the progress of any degradation. Several nonintrusive techniques are currently under investigation. Recent experimental results which demonstrate the feasibility and practicality of the techniques being studied are presented. 4 refs., 6 figs., 2 tabs.

4487 (CONF-8810155—14) Advances in crack-arrest technology for reactor pressure vessels. Bass, B.R.; Pugh, C.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01. Order Number DE89003115/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The Heavy-Section Steel Technology (HSST) Program at the Oak Ridge National Laboratory (ORNL) under the sponsorship of the US Nuclear Regulatory Commission is continuing to improve the understanding of conditions that govern the initiation, rapid propagation, arrest, and ductile tearing of cracks in reactor pressure vessel (RPV) steels. This paper describes recent advances in a coordinated effort being conducted under the HSST Program by ORNL and several subcontracting groups to develop the crack-arrest data base and the analytical tools required to construct inelastic dynamic fracture models for RPV steels. Large-scale tests are being carried out to generate crack-arrest toughness data at temperatures approaching and above the onset of Charpy upper-shelf behavior. Small- and intermediate-size specimens subjected to static and dynamic loading are being developed and tested to provide additional fracture data for RPV steels. Viscoplastic effects are being included in dynamic fracture models and computer programs and their utility validated through analyses of data from carefully controlled experiments. Recent studies are described that examine convergence problems associated with energy-based fracture parameters in viscoplastic-dynamic fracture applications. Alternative techniques that have potential for achieving convergent solutions for fracture parameters in the context of viscoplastic-dynamic models are discussed. 46 refs., 15 figs., 3 tabs.

4488 (EPRI-CS—6077) Effects of targeted chlorination on AL-6X condenser tube corrosion in seawater: Final report. (Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA)). Nov 1988. 63p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002750/JAW.

This report summarizes the results of 1-year corrosion field tests conducted at New England Power Company's Brayton Point Station to evaluate the effects of targeted chlorination on condenser corrosion. Also summarized are the results of a literature review that collected pertinent information on the corrosion effects of chlorination. The results of the field tests produced no evidence that full-scale targeted chlorination trials planned to be started later at the Brayton Point Station would have any adverse corrosion effects. However, the literature review does indicate that the chlorine dosage required to cause detrimental corrosion effects on certain condenser tube materials not tested in this program is within a range that could be observed in power plant cooling water. Further

investigation of the chlorination sensitivity of different condenser tube/tubesheet materials is recommended. 27 refs., 17 figs., 4 tabs.

4489 **(EPRI-NP—6090) The feasibility of using electromagnetic acoustic transducers to detect corrosion in Mark I containment vessels.** Maxfield, B.W.; Kuramoto, A. (Electric Power Research Inst., Palo Alto, CA (USA); Innovative Sciences, Inc., San Leandro, CA (USA)). Nov 1988. 51p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002746/JAW.

The lower portion of the outer surface of the Mark I containment vessel is not readily accessible, yet it is known that corrosion can occur in the lower portion. Potential pulse-echo and through- transmission ultrasonic approaches using low frequency SH plate waves generated using EMATs have been evaluated on a large, 1-inch thick steel plate. This development system was designed to have a transmitter that produced clean forward and back directed lobes and a small receiver that could "map" the incident and scattered displacements for particle motion either perpendicular or parallel to the propagation direction (in each case, parallel to the surface). This approach was chosen so that eventually synthetic aperture signal processing approaches could be used to achieve the best possible discrimination of corrosion scattering from the background of geometrical scatterers and mode conversion. Measurements show that the transmitter beam profile is about as expected from theory. Strong scattering signals are received from 2 wavelength long (5 inch) saw cuts halfway through the plate at distances of at least 15 feet from the scatterer in a pulse-echo geometry. As expected, this signal gets weaker and is spread over a larger angle as the saw cut becomes more rounded. Through-transmission gives relatively poorer detectability for saw cuts less than half the plate thickness. It is expected, however, that transmission measurements may be able to detect quite deep (in excess of 75% wall) corrosion at distances of at least 50 feet from the transmitter. 5 refs., 21 figs.

4490 **(NUREG—1333) Maintenance approaches and practices in selected foreign nuclear power programs and other US industries: Review and lessons learned: Draft report for comment.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications). Nov 1988. 153p. NTIS, PC A08/MF A01 - GPO - OSTI. Order Number TI89003450/JAW.

The Commission recently published a Notice of Proposed Rulemaking on Maintenance of Nuclear Power Plants spelling out NRC's expectations in maintenance. In preparing the proposed rule, the NRC reviewed maintenance practices in other countries and considered maintenance approaches in other industries in this country. As a result of the examination of the benefits of various regulatory approaches, it is concluded that a regulatory approach similar to that adopted by the Federal Aviation Administration is most appropriate for NRC's proposed rulemaking. As a result of the review of maintenance practices, it is concluded that certain practices in the following areas have been found to contribute significantly to effective maintenance: (1) systems approach; (2) effectiveness monitoring; (3) technician qualifications and motivation; and (4) maintenance organization. 37 refs.

4491 **(NUREG/CR—5053) Operating experience and aging assessment of motor control centers.** Shier, W.; Subudhi, M. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (USA)). Jul 1988. Contract AC02-76CH00016. 84p. (BNL-NUREG—52118). NTIS, PC A05/MF A01. Order Number TI89001589/JAW.

As part of the NRC Nuclear Plant Aging Research Program (NPAR), an assessment was made of the characteristics of aging and service wear of motor control centers (MCCs). MCCs perform an important function in the operation and control of a large number of safety-related motors; thus, the operability and reliability of MCCs can impact the overall safety of nuclear plants. This report follows the NPAR strategy and investigates the operational performance, the design and manufacturing methods, and the current maintenance, surveillance and monitoring techniques of MCCs. A significant result described in this report concerns the identification of important MCC failure modes, causes, and mechanisms from plant operational experience. Frequencies of failure determined for the various subcomponents of MCCs also are described. In addition, recommendations are provided for functional indicators to monitor the performance of MCCs. 22 refs., 27 figs., 6 tabs.

2203 Fuel Elements

4492 (INIS-SU—58, pp 72-75) **Pre-reactor examination of experimental fuel elements as a part of the system for complex materials testing post-irradiation studies.** Ivanov, V.B. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

The problems studying complex material testing of experimental fuel elements are considered. Parameter pre-reactor classification is shown to be the necessary part of such studies, because only in comparative analysis of the information received in the course of pre-reactor control and post-reactor investigations, it is possible to increase the estimation accuracy of fuel element "viability" limits. Problems connected with reception, storage and processing of the proper information are discussed. Recommendations on methodologic and metrologic supply of studies are given. 2 refs.

2204 Control Systems

REFER ALSO TO CITATION(S) 4452, 4511, 4544

4493 **(DOE/ET/34002—3) Development and demonstration of surveillance and diagnostics of rotating machinery for reducing radiation exposure to nuclear power plant personnel: Final report.** Allen, J.W.; Bohanick, J.S. (Technology for Energy Corp., Knoxville, TN (USA)). 13 Apr 1988. Contract AC02-79ET34002. 210p. (TEC-R—87-042). NTIS, PC A11/MF A01; 1; GPO Dep. Order Number DE88014714/JAW.

This program was designed to reduce radiation exposure to power plant personnel resulting from inspection, maintenance, and repair of rotating equipment. The new rotating machinery monitoring system for this program was installed at GGNS during August 1983. This document provides a functional description of the hardware and software that comprise the system and discusses the application of the monitoring system to achieving overall program goals. The analyses of the monitored rotating machinery during the plant startup phase and after the plant's first fuel cycle are presented in addition to the radiation dose reduction which occurred as a direct and indirect result of the RMSS. The dose reduction program at GGNS is reviewed and recommendations made to incorporate this program with the RMSS. 28 refs., 64 figs., 43 tabs.

4494 **(WHC-SA—0370) An on-line nuclear reactor diagnostic system using logic programming and analytic redundancy.** Niccoli, L.G.; Brix, L.B.; Corrigan, N.B.; Seeman, S.E.; Alexandro, F.J.; Frank, D.D. (Westinghouse Hanford Co., Richland, WA (USA)). Aug 1988. Contract AC06-87RL10930. 6p. (CONF-8808152—1). NTIS, PC A02/MF A01. Order Number DE89002146/JAW.

From Technical Association of the Pulp and Paper Industry (TAPI) meeting; Pasco, WA, USA (12 Aug 1988).

The system described rapidly identifies both instrument and process equipment failures, including simultaneous failures. System design and technologies used are discussed. Pulp mill applications are outlined. 6 refs., 3 figs., 2 tabs.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 4449, 4503, 5164, 5187, 5229, 5248

4495 (ACIESP—60-Vol.4, pp 326-329) **Environmental monitoring at CNEN/Sao Paulo.** Mazzilli, B. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

In order to evaluate the radiological impact due to the operation of the nuclear facilities available at CNEN/Sao Paulo an environmental monitoring program is carried out. This program was established in order to assure that under normal operational conditions the radioactive effluents generated will not give rise to radiation exposures of members of the public in excess of those stipulated by competent authorities. The program comprises a continuous monitoring of all the radioactive liquid and gaseous effluents generated at CNEN/Sao Paulo, and the measurement of the artificial and natural radionuclide concentration in aquatic, terrestrial and atmospheric samples in the surrounding of the nuclear facilities. Besides, external gamma radiation background in the environment is measured by using thermoluminescent dosimeters.

4496 **(CONF-881024—6) Analysis of data from leaching concrete samples taken from the TMI-2 reactor building basement.** Collins, E.D.; Box, W.D.; Godbee, H.W.; Scott, T.C. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01. Order Number DE89002229/JAW.

From TMI-2 accident materials behavior, plant technology and recovery; Washington, DC, United States (30 Oct 1988).

Samples of contaminated concrete from the basement of the reactor building at the Three Mile Island Nuclear Power Station, Unit 2 were tested and analyzed at Oak Ridge National Laboratory to determine the potential for decontamination by diffusion-controlled leaching under conditions of full submergence and by forced flow-through leaching of porous concrete block walls. Pertinent physical characteristics of the concrete were measured, and leaching tests were performed. Data were analyzed by established mass transport principles, and predictions of leaching for several years were made. A numerical algorithm was used to model removal of ^{137}Cs and ^{90}Sr by forced flow-through leaching. Results indicated that forced flow-through leaching would require only a few days, whereas complete decontamination by submerged, diffusion-only methods would require several years. 9 refs., 8 figs., 8 tabs.

4497 (KFK—4450, pp 181-193) **Investigations on the occurrence and retention of penetrating iodine species in the exhaust air of nuclear power plants.** Reichert, U.; Leskopf, W.; Bleier, K.; Decker, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The alkyl iodides ethyl iodide, isopropyl iodide and pentyl iodide were synthesized in radioactively labelled form and retention experiments with these alkyl iodides using activated carbon SS 207 B as sorbens were discussed.

4498 **(NUREG/CR—2907-Vol.7) Radioactive materials released from nuclear power plants: Annual report 1986.** Tichler, J.; Norden, K.; Congemi, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Administration and Resources Management; Brookhaven National Lab., Upton, NY (USA)). Nov 1988. Contract AC02-76CH00016. 259p. (BNL-NUREG—51581-Vol.7). NTIS, PC A14/MF A01 - GPO. Order Number TI89002952/JAW.

Releases of radioactive materials in airborne and liquid effluents from commercial light water reactors during 1986 have been compiled and reported. Data on solid waste shipments as well as selected operating information have been included. This report supplements earlier annual reports issued by the former Atomic Energy Commission and the Nuclear Regulatory Commission. The 1986 release data are summarized in tabular form. Data covering specific radionuclides are summarized. 16 tabs.

4499 **(PINSTECH/HPD—135) Chernobyl radioactivity and high altitude air-particulate monitoring at Islamabad.** Bhatti, M.S.; Ihsanullah; Shafiq, M.; Perveen, N.; Orfi, S.D. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Health Physics Div.). Nov 1987. 23p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704400/JAW.

High altitude sampling of air particulates for radioactivity monitoring was conducted at Islamabad after the CHERNOBYL accident. Smears from aeroplanes flying at varying altitudes were collected and analysed for fresh fission products mainly gamma emitters e.g. Ru-103 and Cs-137 etc. The maximum radioactivity observed was of the order of 15Bq/sample for Ru-103 and 9Bq/sample for Cs-137 respectively. The study was purely qualitative in nature indicated the presence of fresh fission radioactivity at high altitudes over Islamabad. For quantitative measurements at high altitudes sophisticated instrumentation/procedure needs to be adopted.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 4514, 4854

4500 (ACIESP—60-Vol.4, pp 47-51) **Nuclear research reactor IEA-R1 operation and utilization.** Souza, J.A. de. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The specifications of the brazilian nuclear research reactor IEA-R1 are presented. (E.G.).

4501 **(CONF-881103—13) Digital, remote control system for a 2-MW research reactor.** Battle, R.E.; Corbett, G.K. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE89002349/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A fault-tolerant programmable logic controller (PLC) and operator workstations have been programmed to replace the hardwired relay control system in the 2-MW Bulk Shielding Reactor (BSR) at Oak Ridge National Laboratory. In addition to the PLC and remote and local operator workstations, auxiliary systems for remote operation include a video system, an intercom system, and a fiber optic communication system. The remote control station, located at the High Flux Isotope Reactor 2.5 km from the BSR, has the capability of rector startup and power control. The system was designed with reliability and fail-safe features as important considerations. 4 refs., 3 figs.

4502 **(JINR—R-5-87-848) Approximation of six delayed neutron groups by one equivalent group at a pulsed reactor.** Popov, A.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704393/JAW.

Parameters of one equivalent delayed neutron group are calculated to simplify the analysis of pulsed reactor transients. Parameters are calculated basing on two conditions: 1) equality of steady states of delayed neutron sources for six and one groups; 2) equality of the summary exponential estimates of quality of delayed neutron source transients for six and one groups. Parameters are calculated for various pulsed power periods. It is recommended to choose the parameters from condition of equality of the maximum positive error of approximation and the maximum absolute negative one. 2 refs.; 3 figs.

4503 (OEVS-Mitteilung—1/1988, pp 1-21) **Emission of radionuclids from the Research Centre Seibersdorf.** Steger, F.; Sorantin, H.; Hefner, A. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Strahlenschutz). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

This paper contains data of gaseous and aqueous releases from the nuclear facilities of the Austrian Research Centre Seibersdorf. Presented are emission data from various plants such as ASTRA-Reactor, Safeguard Analytical Laboratory, incineration plant and others. Data of content of radioactive material in effluent waste water are included as well. Maximum permissible values are compared with actual release figures and correlations with dose committements given. An overlook on the environmental protection survey is also included. 9 refs., 2 figs., 7 tabs.

4504 **(PINSTECH/NED—129) Lattice cell analysis and generation of group constants for the proposed leu PARR core.** Arshad, M.; Qazi, M.K.; Bukhari, I.H. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Engineering Div.). Oct 1987. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704402/JAW.

The Pakistan research reactor (PARR) has been operating for the last two decades. The MTR type fuel elements loaded in the PARR are fabricated using 93 per cent enriched uranium and the reactor can be operated with a maximum power level of 5 MW. In this report a typical fuel element, likely to be used is described. The methods applied for the lattice cell analysis and cross-section generation and the results obtained are also discussed. (orig./A.B.). 4 fig.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 4215, 4514, 4515

4505 (OEVS-Mitteilung—1/1988, pp 23-31) **Release of radioactive material with the exhaust air from the Atom Institute of the Austrian universities.** Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

Values of the nuclides /sup 16/N, /sup 14/C, /sup 41/Ar, /sup 131/J and aerosols concentrations measured in the exhaust air of the Triga reactor are given. The results of 22 years of monitoring prove that a research reactor can be safely operated even in an urban area. 6 refs., 1 fig., 2 tabs. (qui).

2209 Reactor Safety

REFER ALSO TO CITATION(S) 4447, 4450, 4456, 4457, 4474, 4486, 4487, 4493, 4496

4506 **(CEGB-RD/B—6009/R88) Critique of methods for dependent failure analysis.** Hughes, R.P. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). May 1988. 13p. (RMWG/P—88-13). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755468/JAW.

Dependent failures make a significant contribution to the failure probability of safety systems. It is important, therefore, that they be taken into account when performing Probabilistic Safety Assessments of nuclear reactors. The way in which the CEGB currently does this is to adopt a "cut-off" as a lower limit for the failure probability of a system. The value of this cut-off is arrived at judgmentally. This approach and various other existing methods are reviewed and the CEGB's requirements for an ideal method for treating dependent failures are listed. It is explained how these methods fail to meet these requirements, and outlines a new method, the Distributed Failure Probability (DFP) approach, which was developed within the CEGB to meet its needs. This DFP approach provides a soundly based and scrutable technique by which dependent failures can be quantitatively assessed, making the best use of both judgment and data.

4507 **(CONF-881011—27) Comparison of effect of insulating blockages on metal and oxide fuel elements.** Tilbrook, R.W.; Dever, D.J. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01. Order Number DE89000538/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

The safety philosophy of the new liquid metal reactor (LMR) plant designs is oriented towards inherent protection against loss of coolable geometry and other entries to core disruption. On potential entry is via propagation of local faults. Within this category is a wide range of initiators which each require assessment of their probability and consequences in order to determine their contribution to plant risk. Local faults include those initiators which cause local power/flow disturbances restricted either to a single subassembly or to a local region of the bundle. The concern is that these localized initiators may start a sequence of events in which fuel failure may propagate first within a subassembly envelope and finally cause loss of coolable geometry in adjacent. This document discusses these scenarios. 3 refs., 1 fig.

4508 **(CONF-881103—14) Post-implementation review of inadequate core cooling instrumentation.** Anderson, J.L.; Anderson, R.L.; Hagen, E.W.; Morelock, T.C.; Huang, T.L.; Phillips, L.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE89002347/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Studies of Three Mile Island (TMI) accident identified the need for additional instrumentation to detect inadequate core cooling (ICC) in nuclear power plants. Industry studies by plant owners and reactor vendors supported the conclusion that improvements were needed to help operators diagnose the approach to or existence of ICC and to provide more complete information for operator control of safety injection, flow to minimize the consequences of such an accident. In 1980, the US Nuclear Regulatory Commission (NRC) required further studies by the industry and described ICC instrumentation design requirements that included human factors and environmental considerations. On December 10, 1982, NRC issued to Babcock & Wilcox (B&W) licensees' orders for Modification of License and transmitted to all pressurized water reactor (PWR) licensees Generic Letter 82-28 to inform them of the revised NRC requirements. The instrumentation requirements for detection of ICC include upgraded subcooling margin monitors (SMMs), upgraded core exit thermocouples (CETs), and installation of a reactor coolant inventory tracking system (RCITS).

4509 **(CONF-8810155—6) Aging assessment of PWR [Pressurized Water Reactor] Auxiliary Feedwater Systems.** Casada, D.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89002228/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

In support of the Nuclear Regulatory Commission's Nuclear Plant Aging Research (NPAR) Program, Oak Ridge National Laboratory is conducting a review of Pressurized Water Reactor Auxiliary Feedwater Systems. Two of the objectives of the NPAR Program are to identify failure modes and causes and identify methods to detect and track degradation. In Phase I of the Auxiliary Feedwater System study, a detailed review of system design and operating and surveillance practices at a reference plant is being conducted to determine failure modes and to provide an indication of the ability of current monitoring methods to detect system degradation. The extent to which current practices are contributing to aging and service wear related degradation is also being assessed. This paper provides a description of the study approach, examples of results, and some interim observations and conclusions. 1 fig., 1 tab.

4510 (CONF-8810155—10) Application of signature analysis for determining the operational readiness of motor-operated valves under blowdown test conditions. Haynes, H.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002315/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

In support of the NRC-funded Nuclear Plant Aging Research (NPAR) program, Oak Ridge National Laboratory (ORNL) has carried out a comprehensive aging assessment of Motor-Operated Valves (MOVs). As part of this work, ORNL participated in the Gate Valve Flow Interruption Blowdown (GVFIB) tests carried out in Huntsville, Alabama. The GVFIB tests were intended primarily to determine the behavior of motor-operated gate valves under the temperature, pressure, and flow conditions expected to be experienced by isolation valves in Boiling Water Reactors (BWRs) during a high energy line break (blowdown) outside of containment. In addition, the tests provided an excellent opportunity to evaluate signature analysis methods for determining the operational readiness of the MOVs under those accident conditions. ORNL acquired motor current and torque switch shaft angular position data on two test MOVs during various times of the GVFIB tests. The reduction in operating "margin" of both MOVs due to the presence of additional valve running loads imposed by high flow was clearly observed in motor current and torque switch angular position signatures. In addition, the effects of differential pressure, fluid temperature, and line voltage on MOV operations were observed and more clearly understood as a result of utilizing signature analysis techniques. 1 ref.; 16 figs.

4511 (CONF-8810155—16) Use of artificial intelligence to enhance the safety of nuclear power plants. Uhrig, R.E. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. Order Number DE89002868/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

In the operation of a nuclear power plant, the sheer magnitude of the number of process parameters and systems interactions poses difficulties for the operators, particularly during abnormal or emergency situations. Recovery from an upset situation depends upon the facility with which the available raw data can be converted into and assimilated as meaningful knowledge. Plant personnel are sometimes affected by stress and emotion, which may have varying degrees of influence on their performance. Expert systems can take some of the uncertainty and guesswork out of their decisions by providing expert advice and rapid access to a large information base. Application of artificial intelligence technologies, particularly expert systems, to control room activities in a nuclear power plant has the potential to reduce operator error and improve power plant safety and reliability. 12 refs.

4512 (CONF-8810155—18) Analysis of the thermal response of a BWR Mark-I containment shell to direct contact by molten core materials. Kress, T.S.; Cleveland, J.C. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01. Order Number DE89002983/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

This study was undertaken to evaluate the thermal response of a BWR Mark-I containment shell in the event of an accident severe enough for molten core materials to fall into the cavity beneath the rector vessel and eventually come into direct contact with the shell. An existing ORNL three-dimensional transient heat transport computer code, HEATING-6, was used for a specific 2-D case (and variations) for which representative melt/shell boundary conditions required as input were available from other studies. In addition to the use of HEATING-6, a simplified analytical steady-state correlation was developed and given the name BWR Liner Analysis Program (BWRLAP). BWRLAP was "benchmarked" by comparison with HEATING-6 and was then used to make a number of parametric calculations to investigate the sensitivities of the results to the inputs. 5 refs., 11 figs., 2 tabs.

4513 (CONF-8810155—19) Contain calculations of debris conditions adjacent to the BWR Mark I drywell shell during the later phases of a severe accident. Hyman, C.R. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003179/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Best estimate CONTAIN calculations have recently been performed by the BWR Severe Accident Technology (BWRSAT) Program at Oak Ridge National Laboratory to predict the primary containment response during the later phases of an unmitigated low-pressure Short Term Station Blackout at the Peach Bottom Atomic Power Station. Debris pour conditions leaving the failed reactor vessel are taken from the results of best estimate BWRSAR analyses that are based upon an assumed metallic debris melting temperature of 2750{degree}F (1783 K) and an oxide debris melting temperature of 4350{degree}F (2672 K). Results of the CONTAIN analysis for the case without sprays indicate failure of the drywell seals due to the extremely hot atmospheric conditions extant in the drywell. The maximum calculated temperature of the debris adjacent to the drywell shell is less than the melting temperature of the shell, yet the sustained temperatures may be sufficient to induce primary containment pressure boundary failure by the mechanism of creep-rupture. It is also predicted that a significant portion of the reactor pedestal wall is ablated during the period of the calculation. Nevertheless, the calculated results are recognized to be influenced by large modeling uncertainties. Several deficiencies in the application of the CORCON module within the CONTAIN code to BWR severe accident sequences are identified and discussed. 5 refs., 9 figs., 4 tabs.,

4514 (CORR—880274) ECS limits: [Deleted Version]. McAllister, J.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 22 Jan 1987. Contract AC09-76SR00001. 5p. NTIS, PC A02/MF A01. Order Number DE89002441/JAW.

New emergency cooling system (ECS) limits were implemented in the SRP reactors in November, 1986, as an assembly emergency cooling limit (ECL). Reactor power is currently 30% below historic reactor power levels because of these assembly ECLs. This memo discusses several items with respect to the new assembly ECLs. First, the core melting which would result from a design basis, double-ended pipe break in a plenum line is discussed, assuming that the new ECLs are correct. Second, the magnitude of the leak from a broken line which would result in no core damage is discussed, again assuming the new ECLs are correct. Third, the ECLs which would result from using best estimate calculations and interpretation of experimental data are discussed. Last, the effect on the ECL of allowing ECS flow from multiple pump sources is discussed. 2 tabs.

4515 (CORR—880275) National Academy of Sciences Committee to Assess Safety at DOE Reactors: Savannah River Production Reactors, October 29-31, 1986: Deleted Version. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; National Research Council, Washington, DC (USA). Committee to Assess Safety at DOE Reactors). 23 Oct 1986. Contract AC09-76SR00001. 173p. NTIS, PC A08/MF A01. Order Number DE89002419/JAW.

This report by the National Academy of Sciences covers: Unique aspects of the Savannah River Plant; SRP reactor design; SRP reactor safety analysis; SRP reactor operational history; Confinement and containments; Reactor PMT maintenance and test program; Emergency plans and procedures; Management of SRP reactor operations; Safety program overview; and SRP reactor training program. (JF)

4516 (EPRI-NP—5580S) Sourcebook for microbiologically influenced corrosion in nuclear power plants. Licina, G.J. (Electric Power Research Inst., Palo Alto, CA (USA)). [1988]. 107p. Unlimited audience, publicly available. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003010/JAW.

This report defines MIC terminology and describes the basic chemical and physical effects produced by microbial activity that affect corrosion of plant materials. It presents case histories, which include detailed color photographs and typical symptoms, that utilities can use as benchmarks or to compare with unexplained corrosion problems. 72 refs. 20 figs., 3 tabs.

4517 **(FMPC—2160) How do you know when you have enough emergency preparedness?: Recommendations for increased professionalism.** DeBusk, R.E. (Westinghouse Materials Co. of Ohio, Cincinnati (USA). Feed Materials Production Center). 1988. Contract AC05-86OR21600. 8p. (CONF-881054—32). NTIS, PC A02/MF A01. Order Number DE89002281/JAW.

From 4. annual DOE model conference; Oak Ridge, TN, USA (3 Oct 1988).

DOE and contractor emergency planners come from diverse backgrounds and lack a consistent base of professional training and orientation. The complexity of emergency preparedness has increased over time and we are now at a critical threshold. We cannot continue to deliver adequate emergency preparedness programs unless we increase the professionalism of our emergency planners. This document calls for an increased emphasis on the professional development of emergency planners. Such a commitment and investment will see returns in improved and more cost-effective programs, including more consistent interpretation of standards, reduced development costs, more sharing of ideas and programs, improved communication will foster proactive approach, and increased internal and public confidence in DOE emergency preparedness. 2 refs.

4518 **(GRS-F—168) List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: 1 April - 30 June 1988.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Aug 1988. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755567/JAW.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning single problems in the field of reactor safety research. According to the cooperation of the Federal Minister for Research and Technology (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Program of the BMFT, reporting organization. The list of reports appears quarterly.

4519 **(KFK—4404) Out-of-pile experiments on LWR severe fuel damage behavior. Tests CORA-C and CORA-2.** Hagen, S.; Sepold, L.; Hofmann, P.; Schanz, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektgruppe LWR-Sicherheit). Sep 1988. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755968/JAW.

In the tests with Al/sub 2/O/sub 3/ pellets, simulating burnable poison rods (98.6 wt.% Al/sub 2/O/sub 3/ + 1.4 wt.% B/sub 4/C), early melt formation at about 1350/sup 0/C was observed. The liquefaction increases distinctly at 1500/sup 0/C. In the resolidified melts two metallic phases: α-Zr(O) and (Zr, Al) alloy and one porous ceramic (ZrO/sub 2//Al/sub 2/O/sub 3/) eutectic can be distinguished. Large blockages form at the lower end of the bundle. In the tests with UO/sub 2/ pellets the melting starts at the elevation of the Inconel grid spacer. By eutectic melt formation in contact with the Zircaloy the liquefaction begins already below the melting point of the Zry and Inconel. Further interaction of this melt with the UO/sub 2/ results in partial dissolution of the pellets. Solidification of the melt led to blockage formation at the lower end of the bundle, but at higher elevations compared to the tests with alumina pellets. At some locations fragmentation of fuel pellets to fine powder took place during cooldown.

4520 **(KFK—4431) Consideration of turbulent deposition in aerosol behaviour modelling with the CONTAIN code and comparison of the computations to sodium release experiments.** Jonas, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Sep 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755970/JAW.

CONTAIN is a computer code to analyze physical, chemical and radiological processes inside the reactor containment in the sequence of severe reactor accident. Modelling of the aerosol behaviour is included. We have improved the code by implementing a subroutine for turbulent deposition of aerosols. In contrast to previous calculations in which this effect was neglected, the computer results are in good agreement with sodium release experiments. If a typical friction velocity of 1 m/s is chosen, the computed aerosol mass median diameters and aerosol mass concentrations agree with the experimental results within a factor of 1.5 or 2, respectively. We have also found a good agreement between the CONTAIN calculations and results from other aerosol codes.

4521 (KFK—4450, pp 35-62) **Mechanical and chemical behaviour of LWR-fuel elements at high temperatures.** Hofmann, P.; Markiewicz, M.; Burbach, J.; Metzger, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung 1 - Teilinstitut Kernbrennstoffe). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

Specimens of once molten relocated materials and fragments were taken from the test bundles and were examined metallographically and SEM/WDX. Al/sub 2/O/sub 3/ has been chemically reduced by metallic Zircaloy to form α-Zr(O) and (Al,Zr) compounds which are liquid above 1350/sup 0/C. The chemical interaction between Al/sub 2/O/sub 3/ and Zircaloy becomes very fast above 1500/sup 0/C. The observed relocated ceramic phase consists of an Al/sub 2/O/sub 3//ZrO/sub 2/ eutectic. In parallel to the CORA tests, separate effects tests have been performed to study the reaction kinetics between Al/sub 2/O/sub 3/ and Zircaloy. Also, liquid Al/sub 2/O/sub 3//liquid Zircaloy and liquid Al/sub 2/O/sub 3//liquid ZrO/sub 2/ interaction experiments have been performed to get information on the resulting reaction products.

4522 (KFK—4450, pp 63-81) **Post-test examination and evaluation of the CORA experiments.** Leistikov, S.; Schanz, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung 2 - Teilinstitut Huell- und Strukturmaterialien). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

CORA-B and CORA-C out-of-pile experiments performed in the CORA test facility are reported. A bundle of 9 unheat and 16 electrically heated fuel rod simulators consisting of Zircaloy-4 cladding, annular alumina pellets, and central heater rod) had been submitted to a temperature-transient of roughly 2000/sup 0/C peak temperature. CORA-B was run under argon atmosphere but with a water-cooled lower bundle head, CORA-C was performed under steam. Both bundles showed comparable damage from steam oxidation, melting and chemical interaction of the metallographically prepared cross sections. Microstructures of Zircaloy-4 tube specimens from earlier high-temperature steam oxidation investigations are discussed. The oxide layer formation and the melting and cladding/scale interaction processes are presented in a sequence of microstructural examples.

4523 (KFK—4450, pp 82-97) **Analysis of the CORA-experiments with the SFD-code SCDAP.** Hering, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The CORA-facility calculations wre performed using the Severe Core Damage Analysis Package (SCDAP). New models to consider out-of-pile features were introduced like models for electric heater rods, alumina pellets and a coolant model with Argon. Some physical models in SCDAP have been improved. The post-test calculations with SCDAP/MOD1 performed so far show a good agreement with the experimental data as for as classical thermodynamics is involved. The deviation of the start of the oxidation excursion can be explained in assuming a material interaction of the Inconel grid spacer with the Zircaloy cladding which may trigger rod failure.

4524 (KFK—4450, pp 98-111) **Aerosol behaviour under core meltdown accident conditions.** Bunz, H.; Koyro, M.; Propheter, B.; Schoeck, W.; Wagner-Ambs, M. Jun 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The NAUA code is considered to be verified for its intended application to calculate aerosol behaviour in the containment during core meltdown accidents. An international code comparison of aerosol behavior codes with a DEMONA experiment showed a good agreement of all calculations with the experiment. Experimental activities in the REST program were started. The objective of the program is to develop and to apply to source term calculations a mechanistic model of revolatilization of fission products from the sump pool in an LWR during severe accidents. The model is to be based on release fractions and size spectra which will be determined in an experimental program accompanying the modelling work.

4525 (KFK—4450, pp 112-128) **Development of models for the analytical determination of core meltdown accidents.** Alsmeyer, H.; Dres, K.; Reimann, M.; Stiefel, S. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

Further development of the WECHSL code has been concentrated on the long term behavior of melt/concrete interaction. Application to the accident gives a slow downward and sideward propagation also after solidification of the metallic melt while the oxidic melt remains liquid. The basemat of 6 meters is calculated to be penetrated after 5 days of interaction. Even if sumpwater ingression is anticipated due to failure of the biological shield after 8 hours, the consequences on downward erosion are very small, and basemat penetration is not prevented as coolability of the melt is not achieved. Model experiments to simulate the sumpwater ingression and melt/coolant interaction over several hours show a limited fragmentation of the upper melt surface only, with a minor effect on downward heat transfer and basemat erosion. The high viscosity of the oxide melt favours the formation of a stable gaspermeable crust several centimeters thick, separating the liquid corium melt and the relatively thin fragmented layer atop.

4526 (KFK—4450, pp 129-133) **Dynamic behaviour of PWR containments.** Eberle, F.; Goeller, B.; Kadlec, J.; Krieg, R.; Lang, G.; Lang, K.H.; Scharnowell, R.; Wolf, E.; Xu, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

A computational procedure to describe the influence of deviations of the containment shell from an ideal spherical shell. Experimenal investigations with a high accurate small scale containment model have been started. In a first step a large number of eigenfrequencies of the almost ideal spherical model has been determined. They are in good agreement with the computational results.

4527 (KFK—4450, pp 152-166) **Validation of the thermal hydraulic code COMMIX-1B using HDR thermal stratification tests.** Baumann, W.; Hansjosten, E.; Schygulla, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projektbereich Heissdampfreaktor - Sicherheitsprogramm/Handhabungstechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

Efforts to validate the 3D thermal hydraulic code COMMIX-1B concentrated on the k-ϵ turbulence model are continued. A total of 3 appropriate HDR-TEMR thermal stratification tests were analyzed by employing laminar and/or turbulent flow option. The results clearly suggest k-ϵ turbulence model algorithms being revised with respect to the phenomenon of turbulent flow relaminarization.

4528 (KFK—4450, pp 194-197) **Development of exhaust filters to be used under extreme conditions.** Dillmann, H.G.; Pasler, H.; Schmitt, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The investigations of stainless steel deep bed filters were continued under various working conditions. Measurement obtained with uranium as a test aerosol resulted in decontamination factors between 10.000 and 20.000 for particle sizes of 0.07 to 0.15 μm respectively. In order to investigate the influence of humidity and droplets, a special filter consisting of a pre-filter and a main-filter was used. Measurement of the decontamination factors obtained for various air velocities and simultanous spraying droplets did not show any influence on the deposition behaviour of the filter. At the clean air side no water could be detected.

4529 (KFK—4450, pp 198-224) **Behavior of HEPA filter systems under accident conditions.** Ruedinger, V.; Benesch, R.; Ensinger, U.; Geckle, U.; Neuberger, M.; Ricketts, C.I. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 2). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

With respect to the behavior of HEPA filters under high humidity conditions, emphasis was placed on the study of the differential pressure increase. Under fog conditions, the differential pressure of dust loaded filters increased within minutes, up to values sufficient to damage normal commercial filters units. The investigation into the failure mechanisms was completed with the development of an equation to calculate filter medium tensile stresses for two of the three most important modes of failure. Initial work was begun toward the development of a computer code to model transient fluiddynamic and thermodynamic conditions in complex air cleaning systems. Further investigation into the transmission of weak shock waves in air-cleaning system ductwork were carried out in branches of ducts with square cross-sections and with variable cross-sections.

4530 (KFK—4450, pp 255-270) **Advanced PWRs (APWRs) and related safety considerations.** Broeders, C.H.M.; Kuesters, H.; Mateeva, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The idea to improve the fuel utilization in LWRs by increasing the conversion ratio to a value near to one. Led to a core with a tight triangular lattice with MOX fuel in modern PWR designs. One of the main problems is to verify that the usual PWR safety criteria are kept valid in this tight lattice PWR concept (APWR). This paper describes the main characteristics of such an APWR, then deals with the calculational procedures and nuclear data sensi-

tivities. A comparison with experiments will show the present day capabilities in calculating the nuclear characteristics of such a tight lattice advanced PWR.

4531 (KFK—4450, pp 282-290) **RELAP5/MOD2 post-test analysis of a forced feed reflood experiment in an electrically heated 61-rod bundle with a tight lattice.** Jacobs, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1988. NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

In order to test the applicability of the LWR-safety code RELAP5/MOD2 on tight fuel rod lattices of advanced PWRs presently being investigated a post-test analysis was performed of an experiment of the FLORESTAN-Programme. RELAP5/MOD2 turned out to be unable to adequately simulate the reflood behaviour observed in the experiment. Modelling effort is needed to extend the capability of RELAP5 towards applications to advanced PWRs, especially for the reflood phase of LOCAs.

4532 (KFK—4450, pp 291-304) **Calculations of the reflooding phase after a loss of coolant accident in advanced pressurized water reactors.** Cigarini, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The one-dimensional multichannel code FLUT was modified in order to allow a good simulation in case of the new APWR geometry (hexagonal rod lattice with integral spiral ribs as spacers). Correlations for the calculation of the wall friction factors in the new core geometry and a newly developed droplet-model which allows a better modelling of the progression of the quench front were introduced in the code. The new version FLUT-FDWR was tested by the post-test calculations of many forced reflooding experiments both in PWR and APWR geometry. The calculations for two different designs of homogeneous APWR were compared with that for a reference PWR (a KWU plant of the 1300 MWe class). The results show that the emergency core cooling system of a conventional PWR plant is able to cool the two considered APWR cores as well.

4533 (KFK—4450, pp 1-34) **Out-of-pile-bundle experiments for severe fuel damage investigations: Test CORA-C with Al/sub 2/O/sub 3/-pellets and test CORA-2 with UO/sub 2/-pellets.** Hagen, S.; Gruenhagen, A.; Heine, R.; Hering, W.; Malauschek, H.; Paroth, N.; Sepold, L.; Wallenfels, K.P.; Vogel, K.; Benz, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

Pellets of Al/sub 2/O/sub 3/ and UO/sub 2/ are used to investigate the behaviour of burnabel poison-rods (Al/sub 2/O/sub 3//Zry) and PWR fuel rods (UO/sub 2//Zry). With a power input increasing to about 30 KW and steam input of about 5 g/s after an initial temperature increase of about 1 K/s, a maximal temperature of about 1900/sup 0/C is reached. The results of the tests CORA-B, - C, -2 and -3 are summarized.

4534 (KFK—4450, pp 225-242) **Modelling and assessment of consequences and risks of accident caused releases of radionuclides.** Al-Omari, I.; Bayer, A.; Burkart, K.; Ehrhardt, J.; Fischer, F.; Hasemann, I.; Matzerath, C.; Paesler-Sauer, J.; Panitz, H.J.; Steinhauer, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

The program system UFOMOD for assessing the radiological consequences of nuclear accidents is completed. A variety of parallel investigations demonstrated its flexibility and increased applicability for studies related to emergency preparedness and to various plants of the nuclear fuel cycle. One of the most important improvements of UFOMOD is the introduction of different trajectory models for describing atmospheric dispersion in the near range and at larger distances. Emergency actions and countermeasures modelling takes into account recommendations of international commissions. The dosimetric models contain completely new age-, sex- and time-dependent data of dose-conversion factors for external and internal radiation; the ingestion pathway is modelled to consider seasonal dependencies. New dose-risk-relationships for stochastic and nonstochastic health effects are implemented; a special algorithm developed for accident consequence codes allows individual and collective leukemia and cancer risks to be presented as a function of time after the accident. According to the modular structure of the new UFOMOD, an easy access to parameter values and the results of the various submodels exists what facilitates sensitivity and uncertainty analyses. To assess the radiological consequences of the reprocessing plant of Wackersdorf in Austria, atmospheric dispersion calculations have been performed. The radiation doses have been assessed with the trajectory models MESOS and RIMPIFF at grid points representative of Passau, Salzburg, Linz and Vienna for normal operation conditions and radioactive releases caused by incidents.

4535 **(LA-UR—88-3557) TRAC PF1/MOD1 calculations and data comparisons for mist feed and bleed and steam generator tube rupture experiments.** Siebe, D.A.; Boyack, B.E.; Steiner, J.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 31p. (CONF-8810155—7). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002299/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

Los Alamos National Laboratory is a participant in the Integral System Test (IST) program initiated in June 1983 for the purpose of providing integral system test data on specific issues/phenomena relevant to post-small-break loss-of-coolant accidents, loss of feedwater and other transients in Babcock & Wilcox (B&W) plant designs. The Multi-Loop Integral System Test (MIST) facility is the largest single component in the IST program. MIST is a 2 {times} 4 [two hot legs and steam generators (SGs), four cold legs and reactor coolant pumps] representation of lowered-loop reactor system of the B&W design. It is a full-height, full-pressure facility with 1/817 power and volume scaling. Two other integral experimental facilities are included in the IST program: test loops at the University of Maryland, College Park, and at SRI International (SRI-2). The objective of the IST tests is to generate high-quality experimental data to be used for assessing thermal-hydraulic safety computer codes. Efforts are under way at Los Alamos to assess TRAC-PF1/MOD1 against data from each of the IST facilities. Calculations and data comparisons for TRAC-PF1/MOD1 assessment are presented for two transients run in the MIST facility. These are MIST Test 330302, a feed and bleed test with delayed high-pressure injection; and Test 3404AA, an SG tube-rupture test with the affected SG isolated. Only MIST assessment results are presented in this paper. The TRAC-PF1/MOD1 calculations completed to date for MIST tests are in reasonable agreement with the data from these tests. Reasonable agreement is defined as meaning that major trends are predicted correctly, although TRAC values are frequently outside the range of data uncertainty. We believe that correct conclusions will be reached if the code is used in similar applications despite minor code/model deficiencies. 7 refs., 5 figs., 2 tabs.

4536 **(LA-UR—88-3571) Quantifying reactor safety margins: Part 1: An overview of the code scaling, applicability, and uncertainty evaluation methodology.** Boyack, B.E.; Duffey, R.B.; Griffith, P.; Katsma, K.R.; Lellouche, G.S.; Levy, S.; Rohatgi, U.S.; Wilson, G.E.; Wulff, W.; Zuber, N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 19p. (CONF-8810155—8). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002297/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

In August 1988, the Nuclear Regulatory Commission (NRC) approved the final version of a revised rule on the acceptance of emergency core cooling systems (ECCS) entitled "Emergency

Core Cooling System; Revisions to Acceptance Criteria." The revised rule states an alternate ECCS performance analysis, based on best-estimate methods, may be used to provide more realistic estimates of plant safety margins, provided the licensee quantifies the uncertainty of the estimates and included that uncertainty when comparing the calculated results with prescribed acceptance limits. To support the revised ECCS rule, the NRC and its contractors and consultants have developed and demonstrated a method called the Code Scaling, Applicability, and Uncertainty (CSAU) evaluation methodology. It is an auditable, traceable, and practical method for combining quantitative analyses and expert opinions to arrive at computed values of uncertainty. This paper provides an overview of the CSAU evaluation methodology and its application to a postulated cold-leg, large-break loss-of-coolant accident in a Westinghouse four-loop pressurized water reactor with 17 {times} 17 fuel. The code selected for this demonstration of the CSAU methodology was TRAC-PF1/MOD1, Version 14.3. 23 refs., 5 figs., 1 tab.

4537 **(LA-UR—88-3846) TRAC-PF1/MOD2 status and plans.** Spore, J.W.; Nelson, R.A.; Steinke, R.; Cappiello, M.; Jenks, R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 22p. (CONF-8810155—20). NTIS, PC A03/MF A01. Order Number DE89003494/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

The development of the TRAC-PF1/MOD1 code was completed in July 1988 with the release of Version 14.4. A TRAC-PF1/MOD2 code development plan addresses code deficiencies identified in the MOD1 code in order to provide an accurate and defensible tool that can be used to simulate large-break loss-of-coolant accidents (LOCAs), small-break LOCAs, and operational transients. The MOD2 code development plan is an international cooperative effort that includes contributions from Los Alamos National Laboratory, Idaho National Engineering Laboratory (INEL), Japanese Atomic Energy Research Institute (JAERI), Cray Research, Central Electricity Generating Board (CEGB), and United Kingdom Atomic Energy Authority (UKAEA). 8 refs., 7 figs.

4538 **(NUREG—1289) Regulatory and backfit analysis: Unresolved safety issue A-45, shutdown decay heat removal requirements.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution). Nov 1988. 177p. NTIS, PC A09/MF A01 - GPO. Order Number TI89003025/JAW.

All light water reactors require decay heat to be removed subsequent to reactor shutdown. Interruption of the decay heat removal function could lead to severe consequences. Concerns about the reliability of the systems and components that assist in the decay heat removal process and the potentially severe consequences of a complete loss of decay heat removal resulted in establishing the requirements for decay heat removal as an unresolved safety issue (USI) designated USI A-45, "Shutdown Decay Heat Removal Requirements." This report presents the regulatory analysis for USI A-45. It includes (1) a summary of the issue, (2) the proposed technical resolution, (3) alternative resolutions considered by the Nuclear Regulatory Commission, (4) an assessment of the benefits and costs of all alternatives considered, and (5) the decision rationale. 23 refs., 9 figs., 39 tabs.

4539 **(NUREG/CR—4960) Control room habitability survey of licensed commercial nuclear power generating stations.** Driscoll, J.W. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and System Technology; Argonne National Lab., IL (USA)). Oct 1988. Contract W-31109-ENG-38. 259p. (ANL—87-22). NTIS, PC A12/MF A01 - GPO. Order Number TI89002950/JAW.

This document presents the results of a survey of control room habitability systems at twelve commercial nuclear generating stations. The survey, conducted by Argonne National Laboratory (ANL), is part of an NRC program initiated in response to concerns and recommendations of the Advisory Committee on Reactor Safeguards (ACRS). The major conclusion of the report is that the numerous types of potentially significant discrepancies found among the surveyed plants may be indicative of similar discrepancies throughout the industry. The report provides plant-specific and generalized findings regarding safety functions with respect to the consistency of the design, construction, operation and testing of control room habitability systems and corresponding Technical Specifications compared with descriptions provided in the license basis documentation including assumptions in the operator toxic gas concentration and radiation dose calculations. Calculations of operator toxic gas concentrations and radiation doses were provided in the license basis documentation and were not performed by the ANL survey team. Recommendation for improvements are provided in the report.

4540 **(NUREG/CR—5135) The thermal hydraulics of SBLOCAs relative to pressurized thermal shock.** Theofanous, T.G.; La Chance, J.L.; Williams, K.A. (Nuclear Regulatory Commission, Washington, DC (USA)). Oct 1988. Contract W-7405-ENG-36. 56p. (LA-UR—88-2871). NTIS, PC A04/MF A01 - GPO - OSTI. Order Number TI89002948/JAW.

The US Nuclear Regulatory Commission (NRC) Pressurized Thermal Shock (PTS) study had previously identified Small Break Loss of Coolant Accidents (SBLOCAs) as a risk dominate accident scenario due to (numerically calculated) primary loop flow stagnation at high pressure. The objectives of the present effort were two-fold. First to develop a physically-based understanding of controlling thermal-hydraulic phenomena producing such PTS SBLOCA stagnation scenarios. Secondly, to use these insights in developing a simple (computationally efficient) "mapping" tool to quantify the occurrence and thermal behavior of such high pressure flow stagnation regimes. Review of the previous (TRAC) calculations revealed that inaccurate modeling of vapor condensation erroneoudly produced flow stagnation and hence overly conservative rapid vessel cooldown rates. Using a corrected version of this code, our new calculations exhibit loop flow. Parametric analysis of less likely (more equipment failure-PORVs/HPI pumps) scenarios revealed that flow stagnation was indeed possible but could only occur at lower pressures. This sample mapping procedure has been favorably benchmarked against the (TRAC) system calculations. This tool is therefore useful for screening possible risk dominant SBLOCA scenarios in various PWR design. 9 refs., 32 figs., 3 tabs.

4541 **(NUREG/CR—5232) Uncertainties in modeling and scaling in the prediction of fuel stored energy and thermal response.** Wulff, W. (Nuclear Regulatory Commission, Washington, DC (USA); Brookhaven National Lab., Upton, NY (USA)). Sep 1988. Contract AC02-76CH00016. 49p. (BNL-NUREG—52164). NTIS, PC A03/MF A01 - GPO. Order Number TI89001080/JAW.

The steady-state temperature distribution and the stored energy in nuclear fuel elements is computed by analytical methods and used to rank, in the order of importance, the effects on stored energy from statistical uncertainties in modeling parameters, in boundary and in operating conditions. An integral technique is used to calculate the transient fuel temperature and to estimate the uncertainties in predicting the fuel thermal response and the peak clad temperature during a large-break loss of coolant accident. The uncertainty analysis presented here is an important part of evaluating the applicability, the uncertainties and the scaling capabilities of computer codes for nuclear reactor safety analyses. The analysis serves to quantify the uncertainty of every fuel-related modeling parameter. Specifically, there are sixteen modeling parameters identified to govern initially the fuel stored energy, and three parameters describing transient boundary conditions for the fuel element. The effect on blowdown peak clad temperature of every fuel-related parameter has been analyzed. The parameters have been ranked in accordance with their impact on blowdown peak clad temperature. The methods employed in this analysis merit general attention because of their simplicity. It is shown that the blowdown peak is dominated by fuel stored energy or, equivalently, by linear heating rate. Gap conductance, peaking factors and fuel thermal conductivity are the three most important fuel modeling parameters affecting peak clad temperature uncertainty. Steam cooling limits the blowdown peak clad temperature. 26 refs., 10 figs., 6 tabs.

4542 **(SAND—88-1398C) Use of probabilistic risk assessments to define areas of possible exemption from regulatory requirements.** Thompson, C.A.; Carlson, D.; Kolaczkowski, A.; LaChance, J. (Sandia National Labs., Albuquerque, NM (USA)). [1988]. Contract AC04-76DP00789. 13p. (CONF-881120—17). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003170/JAW.

From ASME winter annual meeting; Chicago, IL, USA (28 Nov 1988).

The Risk-Based Licensing Program (RBLP) was sponsored by the Department of Energy for the purpose of establishing and demonstrating an approach for identifying potential areas for exemption from current regulatory requirements in the licensing of nuclear power plants. Such an approach could assist in the improvement of the regulatory process for both current and future nuclear plant designs. Use of the methodology could result in streamlining the regulatory process by eliminating unnecessarily detailed reviews of portions of a plant design not important to risk. The RBLP methodology utilizes probabilistic risk assessments, (PRAs), which are required of all future applicants for nuclear power plant licenses. PRA results are used as a screening tool to determine the risk significance of various plant features which are correlated to the risk importance of regulations to identify potential areas for regulatory exemption. Additional consideration is then given to non-risk factors in the final determination of exemption candidates. The RBLP methodology was demonstrated using an existing PRA. The results of the demonstration are highlighted. 10 refs.

4543 **(SAND—88-2212C) Progress report on the containment integrity programs.** Clauss, D.B.; Parks, M.B.; Weatherby, J.R.; von Riesemann, W.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 28p. (CONF-8810155—9). NTIS, PC A03. Order Number DE89002894/JAW.

From 16. water reactor safety information meeting; Gaithersburg, MD, USA (24 Oct 1988).

This paper will focus on recent progress in the Containment Integrity Programs, which are managed by Sandia National Laboratories for the US Nuclear Regulatory Commission. The overall objective of these programs is to develop reliable methods for predicting the performance of LWR containment buildings for loadings beyond their design basis. The basic assumptions and an outline of the analysis methodology are presented. The mechanics of strain concentrations that lead to liner tearing in reinforced concrete containments are explained in terms of an analytical model that accurately represents the behavior of 1:6-scale model that was tested to failure. New insights into the leakage potential of personnel airlocks and equipment hatches based on test results and analyses are described. 20 refs., 20 figs., 5 tabs.

4544 **Self-actuating reactor shutdown system.** Barrus, D.M.; Brummond, W.A.; Peterson, L.F. (to Dept. of Energy, Washington, DC). US Patent 4,770,845. 13 Sep 1988. Filed date 4 Jun 1981. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a self-actuated reactor shutdown system utilizing a thermionic means responsive to at least coolant temperature and utilizing reactor coolant differential pressure for controlling the location of a neutron absorber element with respect to a reactor core region and for effecting release of the absorber element. The improvement consists of: electromagnetic means for controlling reactor coolant flow and coolant pressure differential across the absorber element, and thermionic means responsive to at least reactor coolant over-temperature conditions and operatively connected to the electromagnetic means for short-circuiting the electromagnetic means causing a change in coolant flow and a resulting decrease of the differential pressure across the absorber element allowing the element to drop into the reactor core region by gravitational force.

4545 **Steam trap monitor.** Ryan, M.J. (to Dept. of Energy, Washington, DC). US Patent 4,764,024. 16 Aug 1988. Filed date 4 May 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

For use in a closed steam system, apparatus coupled to a stream trap by means of a pipe and located downstream therefrom for monitoring the steam trap, the apparatus comprising: first sensing means in the pipe for determining the heat energy of a condensate flow in the pipe; second sensing means in the pipe for determining the heat energy of the condensate flow and any flow steam in the pipe; and means coupled to the first and second sensing means for determining the difference between the heat energy of the condensate flow and steam flow and the heat energy of just the condensate flow to detect the presence of any steam in the pipe in monitoring operation of the steam trap.

25 ENERGY STORAGE

4546 **(PNL—6484-Vol.1) Technology transfer for the US Department of Energy's Energy Storage Program: Volume 1, Recommendations.** Bruneau, C.L.; Fassbender, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01. Order Number DE89002806/JAW.

Technologies developed by the US Department of Energy's (DOE) Energy Storage (STOR) Program must be converted into products, processes, or services that benefit the private sector. The process of technology transfer is the primary means of accomplishing this. The purpose of this report is to examine the technology transfer activities of the STOR Program and suggest mechanisms that might make the transfer of technologies from national laboratories and universities to the private sector more effective. A brief summary of recommendations that would improve the effectiveness of the transfer of energy storage technologies from the national laboratories to the private sector is discussed. 33 refs., 2 figs.

4547 **(PNL—6484-Vol.2) Technology transfer for the US Department of Energy's Energy Storage Program: Volume 2, Appendices.** Bruneau, C.L.; Fassbender, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 53p. NTIS, PC A04/MF A01. Order Number DE89002807/JAW.

This document contains the appendices to Technology Transfer Recommendations for the US Department of Energy's Storage Program (PNL-6484, Vol. 1). These appendices are a list of projects, publications, and presentations connected with the Energy Storage (STOR) program. In Volume 1, the technology transfer activities of the STOR program are examined and mechanisms for increasing the effectiveness of those activities are recommended.

2503 Pumped Hydro

4548 **(CONF-8604406—2) Pumped storage plants in ENEL's (Italian Electricity Board) system: planning.** Manzoni, G.; Salvaderi, L. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Apr 1986. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770066/JAW.

From 4. Italo-soviet energy symposium; No City Given, Italy (21 Apr 1986).

The main static design characteristics of pumped storage plants (total generating capacity, total pumping capacity, maximum stored energy in the upper reservoir) have to be defined by taking into account the overall behaviour of the generating system into which the pumped storage plant will be inserted. This examination must be made not only with reference to static duties (spinning reserve, load following, load frequency control). The system's behaviour is also strongly influenced by random forced outages of each unit. The quantitative evaluation of the economic benefits is the basis on which the capacity and main characteristics of these plants should be optimized. This evaluation of system benefits is obtained by means of suitable digital programs which simulate the annual operation, hour by hour, of the whole generating system, including the project under consideration. The simulation, based on probabilistic techniques, takes into account any random variables involved and provides the consequent expected reliability indexes and annual running costs, which, together with capital costs, are the figures used for the optimization.

2504 Capacitor Banks

4549 (CESI—86-2) High voltage power capacitors: testing and service experience. Cesari, S.; Mosca, W. May 1986. 6p. (CONF-8605354—1). NTIS (US Sales Only), PC A02. Order Number DE89770043/JAW.

From 5. BEAMA - international electrical insulation conference; Brighton, UK (19 May 1986).

The paper deals with the results of Italian laboratory and service experiments conducted on commercially available high voltage capacitor units with different dielectric compositions, both mixed paper-polypropylene and all polypropylene film. The tests were performed in order to check the ability of a specific capacitor design and manufacturing process to withstand service stresses. The validity of test methods was checked by service experiments.

2506 Thermal

4550 (PNL-SA—15987) Experimental investigation of interaction between heated ground water and sandstone. McKinley, J.P.; Jenne, E.A.; Smith, R.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1988. Contract AC06-76RL01830. 9p. (CONF-881013—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89001996/JAW.

From JIGASTOCK '88; Versailles, France (18 Oct 1988).

Aquifer Thermal Energy Storage (ATES) test cycles at the St. Paul, Minnesota, USA, Field Test Facility (FTF) have manifested temporal changes in ground-water chemistry and mineral scaling in the heat exchanger and piping. These phenomena result from the heating of ground water and its interaction with the enclosing aquifer. An adequate understanding of the interaction between heated ground water and its enclosing aquifer and the ability to predict the long-term behavior of an ATES system require laboratory studies. Information presented here results from the intersection in reaction vessels of synthetic FTF ground water at 90 and 120{degree}C with sandstone taken from beneath the FTF site. The sandstone, from the Galesville Formation, is a feldspathic quartz arsenite. Examination of reacted solids showed the effects of dissolution of quartz and potassium feldspar. Alkalinity and pH were essentially invariant over the course of the experiments, but most major solution species (Ca, Si, So_4, K) increased with time; Mg decreased over time. Solution Si achieved thermodynamic equilibrium with quartz. Reaction of sediment from which the fine fraction had been removed demonstrated the importance of the contribution to solution of Si, Ca, and SO_4 from the fine fraction. Observed experimental changes in aqueous composition generally parallel observations of field test results. Geochemical and statistical examination of experimental data support the following conclusions: (1) dissolved Si is controlled by equilibrium with quartz; (2) K is supplied primarily by hydrolysis of feldspar; (3) Ca and SO_4 may be supplied by dissolution of a very minor calcium sulfate component of the reacted rock; (4) alkalinity and pH are buffered by precipitation of calcite from heated ground water and reaction with enclosing rock. 6 refs., 6 figs. , 1 tab.

2509 Batteries

4551 (CESI—87-25) Lead acid batteries: correlation between applied loads and long and short-term performances (Performance testing and discharge model). Buccianti, R.; Thione, L.; Menga, P.; Betta, G. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Nov 1986. 10p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770047/JAW.

The results of research on lead acid batteries are reported. Five different types of batteries have been investigated. Typical service stresses were identified for the case of a lead accumulator employed in electric vehicles, photovoltaic plants and conventional systems. Tests were done on non-aged accumulators in the discharge phase and in the presence of different types of electrical and service stresses. The aim of the tests was to identify parameters for the formulation of accumulator models.

4552 (PIRSEM—3027) Superionic conductor based thin films devices for energy storage. (Centre National de la Recherche Scientifique, 75 - Paris (France). Programme Interdisciplinaire de Recherche sur les Sciences pour l'Energie et les Matiernes Premieres (PRISEM)). 1986. 33p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755449/JAW.

A feasibility study concerning a thin films generator with a metal/solid electrolyte/intercalated lamellar compound electrode structure is presented. Various problems are investigated: elaboration and study of the alpha-In2Se3 thin films; intercalation of Li and Ag in In2Se3; study of the ionic conductivity characteristics of B/sub 2/0/sub 3/ - Li0/sub 2/ - Li2S0/sub 4/ glass; and test of a thick type cell with a thin film electrode.

4553 (SAND—88-7100) Nickel hydrogen battery development: Final report. Beauchamp, R.; Sindorf, J. (Sandia National Labs., Albuquerque, NM (USA); Johnson Controls, Inc., Milwaukee, WI (USA)). Aug 1988. Contract AC04-76DP00789. 94p. NTIS, PC A05/MF A01. Order Number DE89001063/JAW.

Development continued on a sealed nickel hydrogen battery for deep discharge, 20-year life, terrestrial energy storage applications that would be cost-competitive with a lead-acid battery. A 7 kWh battery was fabricated, tested, and delivered to Sandia. It consists of four battery modules, each with ten 150 Ah cells in series. These modules are assembled into pressure vessels. The modules are connected in a serials/parallel arrangement resulting in a nominal 300 Ah at 24 volts. During testing at JCI, the battery delivered 7.85 kWh with an energy efficiency of 84%. 10 refs., 22 figs., 26 tabs.

29 ENERGY PLANNING AND POLICY

4554 (CERG-EDP—40) Energy transitions in less-developed countries: analytical frameworks for practical understanding. Pearson, P. (Cambridge Univ. (UK). Cambridge Energy Research Group). Jul 1988. 60p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755535/JAW.

The implications are discussed of interpreting the evolving energy patterns of less developed countries in terms of transitions between traditional and commercial energy forms. The report aims to outline the nature of these energy transitions and their relationships with economic development, to explain their use in analysis and policy and to consider the conceptual and practical problems of studying transitions. Illustrative examples are taken from the USA in the middle of the 19th century and the Republic of Korea after 1960. (U.K.).

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 4259, 4554, 4568, 4581, 4588, 4596, 5217

4555 (CANWEC—1988, pp 110-115) Industrial opportunities from energy in eastern Canada. Lundrigan, H.W.; Bugden, P.B. (The Lundrigen Group Ltd., Corner Brook, Newfoundland; Economic Council of Newfoundland & Labrador). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

Development of eastern Canada's energy resources will create industrial opportunities at provincial, regional, national, and international levels. These opportunities will arise both from the construction, fabrication, and operations associated with these energy projects, as well as from the use of that energy in attracting industrial and commercial customers. To illustrate these opportunities, this paper describes Newfoundland's experience with offshore oil and gas, and compares similar experiences in the United Kingdom in order to examine questions concerning the respective roles of governments and the local business community. A factual com-

parison of oil and gas activity in Newfoundland and the UK is given for 1964-1986, and the performance of domestic industries in those two areas are reviewed. The factors which influence the development of an oil and gas industry is discussed, with a focus on the policies followed by governments in Newfoundland, UK, and Norway to encourage the industry as well as a domestic capability to support such industry. The paper concludes by consolidating the North Sea experience with Newfoundland experience for the purpose of outlining the broad policies that the federal and provincial governments, and domestic industry, must follow to encourage not only the Hibernia offshore project but also other energy developments. 2 refs., 1 fig.

4556 **(CANWEC—1988) Energy opportunities in the nineties. An eastern Canadian perspective.** (Canadian National Committee, World Energy Conference, Ottawa, Ontario). 1988. 162p. (CONF-8710404—; CE—01939). Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN.

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

A conference was held on energy issues relevant to the Atlantic provinces of Canada. Presentations covered energy supply and demand, energy policy, hydroelectric and coal-fired power generation, oil and gas resources from the offshore, and the role of governments. Separate abstracts have been prepared for twenty papers from this conference.

4557 **(DOE/CE/64608—T3) South Carolina Energy Management Finance Authority and third party financing: Project overview.** (South Carolina State Government, Columbia (USA)). Jun 1988. Contract FG01-86CE64608. 261p. NTIS, PC A12/MF A01. Order Number DE89002696/JAW.

Institutional buildings present a unique opportunity and challenge for energy efficiency programs. The barriers to conservation in these public buildings often include cumbersome purchasing and decision-making processes, centralized energy payment procedures, and, most importantly, chronic shortages of upfront funds for capital improvement projects. In 1988, representatives from several South Carolina state government agencies completed work on a project funded under a demonstration grant from the United States Department of Energy. The purpose of South Carolina's Tier 1 Demonstration Project was to encourage the development of nontraditional financing opportunities for energy conservation projects in public buildings. The primary vehicle to achieve this purpose was the design of a framework for a South Carolina Energy Management Authority, which would directly finance energy conservation retrofits in public buildings and other facilities, with repayment being made from energy cost savings. The project also includes technical assistance to private and public institutions interested in obtaining private third-party financing and entering into performance contracting agreements.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 4214, 4411, 4413, 4565, 4682, 5169, 5190, 5191

2904 Natural Resources

REFER ALSO TO CITATION(S) 4254, 4559, 4560

4558 **(SEM/PN—1988) Mineral statistics yearbook, 1986.** (Saskatchewan Dept. of Energy and Mines, Regina (Canada). Petroleum and Natural Gas Div.). [1988]. 146p. (MICROLOG—88-04347). Saskatchewan Dept. of Energy and Mines, Regina (Canada).

This report presents numerical data on fuel and industrial minerals industries in Saskatchewan. Fuel mineral production, sales, and disposition statistics are given for crude oil, natural gas, liquefied petroleum gas, and coal. Other minerals covered by this report are potash, sodium sulfate, salt, and uranium. A section on drilling statistics gives annual, monthly, and historical summaries of such data as well completions and abandonments, and number of meters drilled. Exploratory and development wells are both included. Summaries are also made of crown land dispositions: minerals rights committed, and petroleum/natural gas rights sales. 38 tabs.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 4083, 4098, 4171, 4172, 4317, 4332, 4333, 4334, 4383, 4384, 4386, 4387, 4390, 4392, 4394, 4395, 4397, 4441, 4565, 4566, 4608, 4611, 4612, 4613, 4620, 4633, 4635, 4662, 4670, 4688, 4940, 4941, 5708

4559 **(ARC—1987) Alberta Research Council annual report, 1986.** (Alberta Research Council, Edmonton (Canada)). [1987]. 40p. (CE—02038). Agricultural Research Council of Alberta, 7000-113 St., Edmonton, Alta., Canada T6H 5T6; $N/C.

The Alberta Research Council is a crown corporation of the province of Alberta, offering a diversified range of scientific, engineering and technological research and testing capabilities. The major research program areas are: oil sands and hydrocarbon recovery; coal and hydrocarbon processing; natural resources, including geological studies and mapping, land reclamation, and mathematical modeling; biotechnology; industrial technologies, including testing of gasoline and oil, industrial chemicals, and forest products; advanced, computer-based technologies such as robotics and expert systems; and service to industry. Other services include the Electronics Test Centre for testing, evaluating, certifying, and developing electronic and telecommunications products; and specialized information centres in industrial information, electronic industry information, oil sands, geology, and waste exchange. This report summarizes the year's activities in the foregoing areas, and includes financial statements and a list of publications and patents.

4560 **(ARC—1988) Alberta Research Council annual report, 1987.** (Alberta Research Council, Edmonton (Canada)). [1988]. 46p. (CE—02026). Alberta Research Council, Editing and Publications Sales Dept., 5th. Floor, Terrace Plaza, 4445 Calgary Trail South, Edmonton, Alta., Canada T6H 5R7; $N/C.

The Alberta Research Council is a crown corporation of the province of Alberta, offering a diversified range of scientific, engineering and technological research and testing capabilities. The major research program areas are: oil sands and hydrocarbon recovery; coal and hydrocarbon processing; natural resources, including geological studies and mapping, land reclamation, and mathematical modeling; biotechnology; industrial technologies, including testing of gasoline and oil, industrial chemicals, and forest products; advanced, computer-based technologies such as robotics and expert systems; and service to industry. Other services include the Electronics Test Centre for testing, evaluating, certifying, and developing electronic and telecommunications products; and specialized information centres in industrial information, electronic industry information, oil sands, geology, and waste exchange. This report summarizes the year's activities in the foregoing areas, and includes financial statements and a list of publications and patents.

4561 **(DOE/ER—0327) An assessment of research projects in the Small Business Innovation Research [SBIR] Program.** (USDOE Office of Energy Research, Washington, DC. Office of Program Analysis). Aug 1988. 51p. NTIS, PC A04/MF A01. Order Number DE89002385/JAW.

Public Law 99-443 requires that a report be submitted to Congress in 1988 on the quality of the research and development (R&D) supported by the Department of Energy's (DOE's) Small Business Innovation Research (SBIR) Program, compared to that which is traditionally supported by DOE. This report provides one part of the basis necessary for making that judgment. It documents and analyzes the results of an assessment of the quality of both SBIR and non SBIR projects. DOE traditionally supports civilian R&D projects related to its energy and general science missions. The SBIR program goal is to sponsor high quality R&D on advanced concepts concerning important energy-related scientific or engineering problems and opportunities that could lead to significant public benefit if the search is successful. The SBIR R&D is

limited to performers from the small business community as defined in Section 2.2 of the Small Business Innovation Development Act of 1982, Public Law 97-219. The method of assessment was to obtain independent evaluations of individual projects from knowledgeable reviewers. A procedure developed by the Office of Program Analysis (OPA) over several years for review of DOE programs was followed to perform the assessment. The evaluations were used to compare the quality of the research supported by the SBIR program to that supported by DOE in similar scientific areas and disciplines outside of the program. Projects were reviewed at a series of three meetings in the Washington, D.C., area on May 12--15, June 9--12, and July 21--24, 1987. The reviews were conducted by 17 separate panels of scientific and technical peers, consisting of 4 to 8 members each.

4562 **(LBL—25861) An overview of North American user facilities for electron microscopy in the physical sciences.** Gronsky, R. (Lawrence Berkeley Lab., CA (USA)). Mar 1988. Contract AC03-76SF00098. 1p. (CONF-880841—23). NTIS, PC A02/MF A01. Order Number DE89001266/JAW.

From MAS/EMSA microbeam analysis conference; Milwaukee, WI, USA (7 Aug 1988).

Physical scientists working in North America have access to five major User Facilities for advanced applications of electron microscopy. These Facilities are distributed geographically and provide a wide range of sophisticated instrumentation not normally found in the conventional electron microscope laboratory. Born of the need to maintain state-of-the-art equipment for research in the physical sciences and created because of the increasing cost and sophistication of such instrumentation, they operate on a "shareable" basis, having been funded by the government agencies to serve as regional and national resources, not for exclusive parochial access. 2 figs.

4563 **(LC—83400) Opportunities for Canadian research and development directed toward the needs of the North American auto market.** Hurter, D.A.; Staley, J.L. (Little (A.D.) of Canada Ltd., Toronto, Ontario). Dec 1979. 253p. (CE—01998). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this study is to identify opportunities for increasing Canadian research and development activities that would help improve Canadian autonomy and long term participation in the North American on-road vehicle industry. Information was gathered from reports and visits or meetings with government representatives, manufacturers, industry associations, research organizations, and a university. Opportunities for Canadian participation in both product and process research and development have been identified based on an assessment of factors which are expected to determine the direction of the North American auto industry, such as: possible fuel economy, emission, and safety standards; technological changes to whole vehicles and their components; manufacturing process improvements; current research and development activity; and potential for technology transfer. It was found that certain basic research opportunities could be pursued effectively in Canada because of the existence of Canadian companies that could potentially commercialize the results. Examples of these areas are: material science and processing, vehicle control systems, tire friction and wear, and battery electrochemistry. There appears to be a need for research focusing on needs and problems of a specific industry such as plastics processing, as opposed to the problems of producing a specific component. Canada is seen to be in an excellent position to provide many of the auto industry's raw materials, because of the existing combination of materials resources, energy, and industry capabilities. A number of company-specific opportunities were also discovered. 9 refs., 2 figs., 45 tabs.

4564 **(NRC/E—8312) The implementing agreements for the programmmes of research, development and demonstration of the International Energy Agency. A summary, 1976-1983.** (National Research Council of Canada, Ottawa, Ontario. Div. of Energy). Dec 1983. 29p. (In English and French). (CE—01995). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This document presents, in tabular form, the following information on the National Research Council of Canada's commitments to the programs of cooperative research, development and demonstration of the International Energy Agency: name of agreement and participating personnel, objectives, date that the Council joined, participating countries, and extent of budgetary and/or personnel commitment. These commitments are in the areas of bioenergy, energy end-use efficiency, fusion energy, hydrogen, wave power, solar heating and cooling, and wind energy conversion.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 4475, 4476

4565 **(EML—504) 1985-86 biennial report of the EML regional baseline station at Chester, New Jersey.** Chieco, N. (ed.). (USDOE Environmental Measurements Lab., New York). Oct 1988. 185p. NTIS, PC A09/MF A01. Order Number DE89002705/JAW.

The Environmental Measurements Laboratory (EML) has maintained a field station at Chester, NJ since 1976. Located 64 kilometers west of EML, the site is on the property of Bell Communications Research and is a little more than 900 square meters in area. The Chester site is a rural facility which provides us with an opportunity to carry out "regional baseline" research and to test field instruments. This report updates the various programs underway at Chester and presents data that have become available since the last report. Individual reports are processed separately for the data base.

2910 Conservation

REFER ALSO TO CITATION(S) 4557, 4635, 4659, 4665, 4666

4566 **(BNL—41876) Planning building energy conservation research in the US.** Abel, F.; LaMontagne, J. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-880920—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003156/JAW.

From International symposium on energy options for the year 2000; Wilmington, DE, USA (14 Sep 1988).

In the US, the federal government plays a key role in the development of energy conserving technologies and practices for buildings. The Office of Buildings and Community Systems (BCS) of the US Department of Energy provides federal leadership for both private and public sector activities in building energy conservation. The federal role in recent years has been largely limited to the development of technical options; behavioral and institutional factors are considered only to the extent necessary to inform the research planning process. Planning in the US requires dealing with uncertainties regarding the federal approach to energy conservation; this can change, often dramatically, with changes in administrations or changing economic and energy conditions. Thus federal research plans must be designed to be useful in a wide variety of circumstances. 7 refs.

4567 **(IKE—8-12) Evaluation of modernisation measures on housing in Suessen under the aspects of energy-saving and cost efficiency. Pt. 5. Final summing up and report.** Scheirle, N.; Thoene, E. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). May 1985. 84p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755152/JAW.

Various measures to reduce the indoor heating requirement in buildings chosen for modernisation in the Suessen local authority area were carried out, measured and assessed. Different kinds of insulation were fitted to the houses during modernisation and new heating systems installed. Thermal insulation of the buildings proved to be the most economical modernisation measure. The novel heating systems were expensive to buy, as they involved high installation costs in addition to the price of the appliances. The challenge to the manufacturers is that they should offer low-cost and industrially produced complete systems. The study was carried out in 4 parts, each of which examined one of the following prob-

lem areas for energy savings and cost efficiency: - various insulation measures, - bivalent alternative electrical heat pumps, - gas absorption heat pump, - bivalent partially-parallel electric heat pump with simultaneous heat utilisation from flue gases. This report sums up the project. The detailed results are to be found in the previously published reports.

4568 **(NECA—1988) Letting conservation compete for energy dollars. A policy imperative.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). 1988. 22p. (In English and French). (CE—02020). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $N/C.

This paper presents the argument that Canadian energy policy in general misconceives and undervalues conservation, to the detriment of the provincial and national economies. Conservation is perceived as a useful but temporary player in the energy supply and demand situation, and when fuel supplies are ample, the rationale for promoting conservation seemingly disappears. Examples are given to show that traditional methods for forecasting future energy consumption do not take into account state-of-the-art efficiencies possible in the end uses of energy. As a first step in a new approach to energy planning, it is suggested that improvements in existing energy efficiencies, if achieved in large quantities on a predictable schedule, constitute an energy resource. Advantages of such an approach include short lead times, modest scale of investment, wide dispersal, reduced risk of investment recovery, flexibility, and increased job creation. Current Canadian policy is more attuned to energy production incentives rather than to encouraging conservation. Recommendations for a sound energy conservation program for Canada are summarized in the areas of preparation of least-cost energy supply plans, and improving Canada's capacity to exploit cost-effective conservation opportunities. 1 tab.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 4556, 4582, 4603, 4605, 4606, 4607

4569 (CANWEC—1988, pp 134-139) **Newfoundland and Labrador.** Peckford, A.B. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This presentation provides the perspective of the leader of Newfoundland on energy developments in that province, and the role of governments in developing energy sources. There are impasses in developing hydroelectric power and offshore oil/gas resources due to the province's inability to handle large scale projects. An improved relationship between provincial and federal governments and the energy companies is felt to be required.

4570 (CANWEC—1988, pp 130-133) **Quebec.** Bujold, R. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper presents some of the policies of the Quebec government undertaken to achieve the objectives of: favoring competition in the Quebec energy market; ensuring and reinforcing security of energy supplies; and supporting, in the energy sector, a policy of economic development and job creation. These policies include encouraging hydroelectric dvelopment, supporting deregulation of natural gas, encouraging energy efficiency in the Quebec economy, and using the province's hydroelectric resources to achieve economic growth through exports and by attracting electricity-consuming industries.

4571 (CANWEC—1988, pp 128-129) **Prince Edward Island.** Ghiz, J. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This presentation provides the views of the leader of Prince Edward Island on energy opportunities in that province. Background information on the province's energy situation shows that it has no conventional energy sources and must rely on imported energy to satisfy most of its demand. Policies have been implemented by the provincial government to ensure energy security and fair energy pricing, including regulation of petroleum based fuel prices. To overcome the Island's high electricity prices, an interprovincial electricity grid is proposed to encourage and permit the free flow of electrical energy within Canada. And, as an alternative to these conventional energy sources, recent developments in biomass energy are described, including wood chip fired boilers used to heat government buildings, and a 10 MW wood chip fired power plant planned to be operational in the early 1990s.

4572 (CANWEC—1988, pp 126-127) **New Brunswick.** O'Connor, A.J. (New Brunswick Power). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper presents the views of an electric utility official on developments in energy sources in New Brunswick. The main energy source in the province for electric power is coal, and plans for expansion of coal fired generating facilities are outlined. These include a 200 MW thermal station planned for 1991 service and units of the 400 MW class for 1994 and 1998, to use either local or imported fuel. Wood waste resources are mentioned as a possible energy source for smaller sized facilities. Several research programs in combustion technology are also outlined.

4573 (CANWEC—1988, pp 83-85) **The energy potential of Newfoundland and Labrador.** Peckford, A.B. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This presentation describes the views of a Canadian provincial leader on the hydroelectric and petroleum resource potential of Newfoundland and Labrador. The role of the provincial government in getting its proper share of energy resource development is discussed. Constraints to initiating developments whose technical feasibility have already been determined are mentioned in the context of offshore oil and gas development, and the exploitation of hydroelectric potential on the lower Churchill River. These include a tendency to consider new energy developments as regional rather than Canadian concerns, and the lack of an appropriate federal policy on electric power transmission through interprovincial boundaries.

4574 (CANWEC—1988, pp 23-26) **Atlantic Canada's energy future - a perspective.** Murphey, L.J. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper examines the important features of Atlantic Canada's energy demand and supply flows, both current and projected. An analysis of end-use demand shows that the Atlantic provinces' consumption patterns in the commercial, residential and transportation sectors are not very different from the rest of Canada. The use of energy in the industrial sector, however, leads to a high overall rate of energy use in the region. On the supply side, the region produces less than 50% of its needs, with energy production limited to electricity, coal, and wood. Nevertheless, by improvements in efficiency on the demand side and through the options created by new sources of oil and gas, the region has a broad range of opportunities to become not only self-sufficient in energy but also an energy exporter. Economic, commercial and political criteria affecting energy development are briefly discussed. 10 figs.

4575 (DOE/EIA—0035(88/07)) Monthly energy review, July 1988. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 26 Oct 1988. 142p. NTIS, PC A07/MF A01 - GPO - OSTI. Order Number DE89002373/JAW.

This article presents energy severance taxes and effective energy severance tax rates for crude oil and natural gas and for coal both at the national level and by State for the 1972 through 1987 period. The reasons for the dramatic changes that occurred during the period are analyzed.

4576 (EMPR/ER—1988) British Columbia energy supply and requirements forecast update, 1987-1992. (British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria (Canada). Energy Resources Div.). Mar 1988. 52p. (MICROLOG—88-04623). British Columbia Ministry of Energy, Mines and Petroleum Resources, Publications Distribution, Parliament Buildings, Victoria, B.C., Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents an overview of British Columbia's energy supply and requirements, outlines projections of oil, natural gas and electricity prices, reviews primary and secondary energy use, and summarizes the energy supply outlook for the province. A final section of the report examines some key forecast sensitivities. Total primary energy requirements are projected to increase 1.7%/y to 984 PJ in 1992, with the commercial sector and the pulp and paper industry experiencing the highest rates of growth in energy consumption. Lower energy prices will reduce but not reverse the rate of improvement in energy efficiency. The surplus in hydroelectric power is expected to disappear by 1990; electricity price increases are expected to be less than inflation. End-use electricity requirements are projected to grow 2.5%/y to 209 PJ in 1992. The province has more than sufficient deliverability of natural gas to meet domestic demand and export commitments. Deregulation has lowered gas prices, which will be firm by 1992 as the supply surplus dissipates; requirements will grow 3.4%/y to 226 PJ in 1992. Oil production will decline to 54 PJ in 1992, increasing dependence on Alberta supplies. World oil prices are expected to remain constant in real terms over the next 5 years. Demand for refined petroleum products is forecast to decline to 338 PJ in 1992. 36 figs., 3 tabs.

4577 (ENEA-RT-FARE—88-5) Italian energy consumption: tertiary activity. Guarino, D.; Minischetti, M. (ENEA, Rome (Italy)). Apr 1988. 49p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755370/JAW.

Tertiary activities (hospitals, hotels, trading centres, sport centres, schools, lighting installations, barracks, buildings office-use, service water systems, etc.) represent a large percentage of national (Italian) energy consumption. The purpose of this paper is to evaluate energy consumption (due to space heating, water heating, summer air conditioning, lighting, etc.) and potential energy savings. The study has been performed with the use of national statistical information, estimates of specific consumptions and information obtained from utilities. More significant results concern total consumption in each field and the energy intensity of the various components of the tertiary sector having average characteristics or large diffusion. The total energy consumption is about 8.1 Mtpe/year (primary energy). Possible energy savings of from 20 to 30% have been estimated.

4578 (EPRI-P/EM—6008) Office productivity tools for the information economy: Possible effects on electricity consumption: Final report. Roach, C. (Electric Power Research Inst., Palo Alto, CA (USA); Boston Pacific Co., Washington, DC (USA)). Oct 1988. 67p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89003009/JAW.

Based on a systematic and quantitative approach, the report analyzes the potential impacts of widespread introduction of office productivity tools{endash}mainframes, mini-computers, microcomputers, point-of-sale terminals, etc.{endash}on electricity consumption in the commercial sector. The analysis shows that these information technologies could significantly add electricity use by commercial customers in their quest for increased competitiveness by using these technologies to improve service productivity and management efficiency.

4579 (ERCB—8805) Energy requirements in Alberta; 1988-2002. (Energy Resources Conservation Board, Calgary, Alberta (Canada)). May 1988. 44p. (CE—01955). Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, Alta., Canada T2P 3G4; $10.00 CAN.

Alberta's primary energy requirements are the energy resources needed to satisfy Alberta consumers and industries. They include energy resources processed in the province to produce other products, and energy resources that are used by Alberta consumers but in a manner that does not require prior processing. Secondary energy requirements are the resources and energy productes needed to satisfy the day-to-day needs of Albertans, including energy for space heating, transport fuel, and electrical energy. Neither category includes energy resources produced in Alberta but delivered to markets beyond the province without prior processing. This report presents a revised forecast of Alberta's primary and secondary energy requirements, and two scenarios are developed to provide a range for future energy requirements. At the time of writing, the high price scenario is considered to be the preferred one, and most of the data in this report reflect this scenario. Preliminary chapters outline the social, political, and economic factors that may influence energy requirements. Profiles of the various energy sectors of Alberta (oil sands, petrochemicals, refineries, forest products, conventional fossil fuels, and electricity) are also given. 13 figs., 13 tabs.

4580 (NP—9770095) Study about meeting the energy demand by an alternative way contrarily to fuel oil heating for the Rhine-Neckar region (conception of supply). Final report. Winkens, H.P. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). May 1984. 928p. (In German). NTIS (US Sales Only), PC A99. Order Number DE89770095/JAW.

For an area of concentration and a rural district (Rhine-Neckar region) the quantity of heat required for space heating and industrial processes has been determined. Basing on the investigation the data of the economies due to heat insulating and saving energy have been extrapolated up to the year 2000. The technologies of energy supply and application (electricity, natural gas, district heat, heat pumps, solar energy, regenerative energy carriers, industrial waste heat and refuse utilizing) are shown; costs and potentials of them are determined for the region of investigation. In this, energy supplying with feeder lines is of considerable importance. Finally, there are given recommendations about measures for forced introduction of the alternative way of meeting the energy demand - contrarily to fuel oil heating. (orig.) With 117 refs., 163 tabs., 258 figs.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 4556, 4557, 4565, 4569, 4570, 4571, 4572, 4573, 4610

4581 (CANWEC—1988, pp 119-122) **Energy and the Free-Trade Agreement.** Masse, M. (Energy, Mines & Resources, Canada). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This presentation provides the views of the Canadian energy minister towards the Canada-USA Free Trade Agreement with respect to its effects on Canada's energy sector. As a background, the changing market environment for energy in Canada is noted as being deregulated and market-oriented compared to earlier situations. This leads to the idea that the Agreement is a culmination of earlier trends. The specific aspects of the Agreement as they relate to energy are then broadly outlined, and concerns and criticisms of the Agreement are evaluated. The evaluation includes discussion of

issues of ownership, markets, supplies, export restrictions and taxes, and the role of governments in achieving national energy goals.

4582 (CANWEC—1988, pp 39-42) **Some observations on the challenges of developing an appropriate energy policy.** Sununu, J.H. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This presentation indicates the views of a state governor on the processes of forming energy policy and the roles of the private sector and government in this process. The problems associated with using forecasts of energy supply and demand, the lack of effective communication by the private sector to non-expert policymakers, and the perceptions of the public with regard to energy supplies are discussed. The electric powr situation in the Northeast USA is used to illustrate the relative lack of action on future energy development in this area and the delay in even considering supply policy questions.

4583 (EMR/MB—RFC72/95-CCRL, pp 3-6) **The Canadian energy situation.** MacNabb, G.H. Dec 1973. CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum. (CONF-7205129—; CE—01973).

From Coal-in-oil seminar; Ottawa, Canada (17 May 1972).

This paper examines the Canadian energy situation in terms of the current problems in the energy sector, and the problems that have to be resolved in the process of developing a Canadian energy policy. Although Canada is not foreseen to have shortages of supply, energy prices are expected to rise. This leads to the consideration of aspects other than volume of supply in energy policy formulation. Such considerations range from exploration through to marketing. Some current issues relating to this are outlined, including coal supplies to Ontario, long distance power transmission, and tar sands development. In examining national energy policy, the broader implications of these issues must be addressed, in effect requiring a concern with the entire economy and not just with the energy economy. This is illustrated by examining capital requirements for the energy industries, which may bring about a need for special fiscal measures if capital needs reach the upper end of the forecast $50-70 billion range. A proper balance also needs to be achieved between reasonable growth in energy industries and protection of the environment. Successful research and development, such as that being conducted in the Fuels Research Centre of the Department of Energy, Mines and Resources, is seen as having major implications for the policy issues and objectives outlined in this paper.

4584 **(EO—M27-87/1987E) The energy question.** (Energy Options, Ottawa, Ontario (Canada)). 1987. 28p. (CE—02008). Energy Options, PO Box 4518, Ottawa, Ont., Canada K1S 5B5; $N/C.

This booklet introduces the Energy Options program, a process for drawing out a wide range of views on various Canadian energy issues for consideration by an advisory committee of the federal energy ministry. The process is a nationwide series of conferences, seminars, research, and reports designed to give Canadians the chance to re-evaluate Canada's energy future. The kinds of issues addressed relate to the kinds of energy that may be available, the environmental aspects of energy use, cooperation with other governments, energy exports, improvements in energy conservation and efficiency, and supply security. An overall objective is to assist in forming an energy policy that is based on principles of economic efficiency, environmental sustainability, security of supply, and equity. 27 figs.

4585 **(NECA—1988) Satisfaction guaranteed! An evaluation of the need for a national warranty program.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). [1988]. 45p. (CE—02019). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $N/C.

This document presents the rationale for a proposed Canadian warranty program for consumers who deal with residential contactors. Such a program is felt as having the potential of becoming a catalyst to consolidate the energy conservation retrofit industry. Surveys were conducted of Canadian homeowners regarding contractors, and results showed major concerns with contractor performance. Most wanted some form of third party involvement to protect against the risks in dealing with contractors. A warranty program would improve market stability and contractor credibility. A national program is proposed whose key components are: a third party insurance fund; a standard form contract; mechanisms for repaying deposits and for completing the work if a job is left uncompleted; and means for correcting defects in materials and workmanship. One of the major benefits of such a program to the contractor is that it can provide improved access to financing and enable shared promotional activities. 22 figs.

4586 **(NP—8755009) Energy in Denmark. Status report. Energy planning 1987.** (Energiministeriet, Copenhagen (Denmark)). 1987. 75p. Risa Library, DK-4000 Roskilde. Order Number TI88755009/JAW.

The status report contains an account of historical developments as well as future projections based on assumptions concerning future energy use and structure of supply systems. Furthermore the report gives accounts of the measures being taken to avoid an extension of electricity production capacity and the general trends for oil and gas production. (SM).

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 4081, 4130, 4173, 4555, 4559, 4560, 4575, 4583, 4597, 4611, 5130

4587 **(AE/P—162) Alberta Petroleum Incentives Program Fund annual report, 1986/87.** (Alberta Energy, Edmonton (Cañada). Petroleum Div.). [1987]. 13p. (MICROLOG—88-04833). Alberta Petroleum Incentives Program Fund, Communications Section, 855 - 8th Ave., SW, Calgary, Alta., Canada T2P 3P1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Alberta Petroleum Incentives Program (APIP) was created in November 1981. APIP's objective is to encourage the exploration and development of Alberta's petroleum and natural gas resources. The program also supports work on tertiary oil recovery projects. Under the program, eligible applicants may obtain APIP incentive payments equal to a percentage of their incurred eligible costs and expenses, including exploration and development expenses for oil and gas wells; geological and geophysical expenses, and development drilling and asset costs related to tertiary oil recovery projects. The APIP office is in Calgary , where the majority of headquarter operations associated with Alberta's oil and gas industry are located. This report of the year's activities includes a summary of incentives paid and the financial statements of the APIP Fund.

4588 (CANWEC—1988, pp 99-100) **Eastern Canadian natural gas resource and development prospects.** MacLeod, J.M. (Shell Canada Ltd.). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

A discussion of the exploration and development of natural gas resources in Atlantic Canada is presented. Activities have been concentrated in the offshore areas of Nova Scotia, and have resulted in discovery of five areas in the Sable Island Basin that have developmental potential. Investment to develop these areas for market would require installation of platforms and pipelines in addition to drilling and well completion. The regional Canadian market could not use all the gas so produced, and a pipeline would also have to be constructed to export gas to the USA. Total investment required would be about $4.4 billion, or $1.30 per million ft/sup 3/

of reserves. This is not cost competitive at the currently depressed state of the natural gas market.

4589 (CANWEC—1988, pp 90-93) **The possibility of developing oil in eastern Canada - is it wishful thinking or a plausible possibility?.** Matzke, R.H. (Chevron Canada Resources Ltd.). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

The development of offshore oil resources in Atlantic Canada is outlined. Corresponding development in the North Sea is used to illustrate progress that could have been made in exploiting these resources. Total investment of ca $6 billion over 16 years has resulted in discovery of over 40 oil and gas accumulations, and a table of the most significant oil discoveries is presented. Basic technology, including gravity-based platforms, ships, and undersea connections are also described briefly. 6 figs., 1 tab.

4590 (CANWEC—1988, pp 32-36) **Oil: scarcity of security?.** Sparrow, B. (House of Commons Standing Committee on Energy, Mines and Resources). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper presents the views of a Canadian government committee on the future prospects of Canadian oil supplies. The committee studied future light crude oil availability and Canada's oil resources, and made recommendations relating to such supplies. It was seen that world oil resources are asymmetrically distributed, with light petroleum fuels mainly found in the Eastern Hemisphere and heavy fuels in the Western. The capability to boost production of conventional oil in both the short and long term lies with the OPEC countries, which led to the view that oil is not simply another economic commodity but needs some kind of government role in its development. Another important conclusion was that the USA will increasingly look to Canada for energy supplies in the 1990s. Low oil prices have made Canadian nonconventional and frontier oil developments less feasible. Recommendations made in light of the committee's study included the establishment of a strategic oil reserve, creating an environment to encourage domestic petroleum exploration and development, undertaking studies on pipelines in the Mackenzie Valley area, encouraging the USA to explore for and develop petroleum resources in Alaska, provide foreign aid to developing countries for petroleum development, continue Federal incentives for using natural gas and propane as vehicle fuels, and increasing funding for relevant research and development programs. 5 figs.

4591 (CANWEC—1988, pp 27-31) **The eastern seaboard perspective.** Jones, S.T. (Wharton Econometrics). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper discusses opportunities for export of natural gas and electricity from eastern Canada. Gas spot prices are projected to the year 2000 and maximum gas exports to the USA are projected at 1.8 trillion cubic feet by 2000. Results of a study on electricity exports, assuming that 3,600 MW units are built to provide power solely for export, show major cost reductions in power generation and transmission would result if such facilities were built. 3 figs., 1 tab.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 4611, 4612

2960 Electric Power

REFER ALSO TO CITATION(S) 4253, 4344, 4432, 4433, 4436, 4591

4592 **(AD-A—197013/6/XAB) Military standard generators prototype modifications. Volume 1, 15-kW DOD generator set. Final report, 17 July 1987-31 March 1988.** Adolph, R.J.; Tanner, J.D. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 31 Mar 1988. 409p. (VSE/ASD—0088-88/15RD-VOL-1). NTIS, PC A18/MF A01.

See also Volume 2, AD-A197 014.

This report consists of three volumes: Volume I - 15-kW DoD Generator Set; Volume II - 30-kW DoD Generator Set; Volume III - 60-kW DoD Generator Set. Government-approved modifications to the military standard 15-kW Diesel-Engine-Driven (DED) Generator Set were made to reduce noise levels, and improve reliability. Tests performed to a government-approved test plan showed all design changes to be sound in concept. Further reliability testing should be accomplished after deficiencies resulting from testing are corrected.

4593 **(AD-A—197014/4/XAB) Military standard generators prototype modifications. Volume 2, 30-kW DOD generator set. Final report, 17 July 1987-31 March 1988.** Adolph, R.J.; Tanner, J.D. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 31 Mar 1988. 441p. (VSE/ASD—0088-88/15RD-VOL-2). NTIS, PC A19/MF A01.

See also Volume 3, AD-A197 015; Availability : Document partially illegible.

This report consists of three volumes: Volume I - 15-kW DOD Generator Set; Volume II - 30-kW DOD Generator Set; Volume III - 60-kW DOD Generator Set. Government-approved modifications to the military standard 30-kW Diesel Engine Driven (DED) Generator Set were made to reduce noise levels, and improve reliability. Tests performed to a government-approved test plan showed all design changes to be sound in concept. Further reliability testing should be accomplished after deficiencies resulting from testing are corrected.

4594 **(AD-A—197015/1/XAB) Military standard generators prototype modifications. Volume 3, 60-kW DOD generator set. Final report, 17 July 1987-31 March 1988.** Adolph, R.J.; Tanner, J.D. (VSE Corp., Alexandria, VA (USA). Army Systems Group). 31 Mar 1988. 168p. (VSE/ASD—0088-88/15RD-VOL-3). NTIS, PC A08/MF A01.

See also Volume 1, AD-A197 013.

This report consists of three volumes: Volume I - 15-kW DoD Generator Set; Volume II - 30-kW DoD Generator Set; Volume III - 60-kW DoD Generator Set. Government-approved modifications to the military standard 60-kW Diesel Engine Driven (DED) Generator Set were made to install a new engine, reduce noise levels, and improve reliability. Tests performed to a government approved test plan showed all design changes to be sound in concept. Further reliability testing should be accomplished after deficiencies resulting from testing are corrected.

4595 **(BCH/RP—20/5/824) B.C. Hydro twenty-year resource plan for the period 1988 to 2007.** (British Columbia Hydro, Vancouver (Canada). Resource Planning Corporate Affairs). Mar 1988. 66p. (MICROLOG—88-04669). Residential and Commercial Energy Management, B.C. Hydro, 3 - 1265 Howe Street, Vancouver, B.C., Canada V6Z 2C8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes British Columbia Hydro's plans to meet future customer requirements for electricity within prescribed standards and also in accordance with Hydro's objectives as a provincial agency. These plans are intended to balance of service and rate levels; address environmental and regulatory concerns; and

consistently optimize the supply, marketing and management of existing and planned resources. The most recent electricity demand projections are ca 1400 GWh higher for the mid-1990s than forecast the year before. Uncertainty in the long-term provincial economic outlook is reflected in a range of possible forecast outcomes. The firm hydro surplus situation is expected to last until 1989. Combined existing generation capacity plus limited off-peak purchases from Alberta are sufficient to satisfy demands until about 1995. Beyond that time, rapidly increasing supply costs and unacceptable service risks require the addition of new resources. The short term response is to utilize all possible opportunities to ensure efficient management of existing resources, including promotion of energy saving measures. In the longer term, this year's plan continues to move in the direction of increased reliance on purchases and coordination agreements with other energy producers. Selection of the next generation addition to the system around 2000 focused on 3 projects that offer the lowest costs. The plan was analyzed to determine how it could be modified to respond to different growth scenarios, and to potential unavailability of currently scheduled resources. 7 figs., 9 tabs.

4596 (CANWEC—1988, pp 73-79) **Future generation developments and requirements for implementation.** Titus, G.L.; Flynn, C.T.; Wong, H.P.; Bartlett, D.B. (New Brunswick Power). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper examines how a regional generation expansion plan, incorporating power exports to the USA, would contribute to economic growth in the Canadian Maritime provinces. Constructing four 500 MW coal-fired units in the 1990s would result in net exports of 14 TWh/y, thereby increasing regional power produciton by 50%. Economic effects of this would include a potential for $2.5 billion in total investment for generation alone; a potential for 40,000 man-years of employment relating only to power plant construction, with 400 operating jobs in the plants; and a potential to increase the regional gross domestic product by ca 1%/y during 1992-1998. This overall development would require regional and federal cooperation, development of certain infrastructures and technologies, proper attention to legal and taxation aspects, and cooperation of labor. 6 figs., 1 tab.

4597 (CANWEC—1988, pp 61-72) **The potential for additional coal-fired generation.** Brown, D.G. 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper examines the market demand for coal-fired electric power in the Canadian Atlantic provinces, with consideration of the potential for export of such power from that region. Forecasts of regional load are presented and a series of expansion plans are presented based on this forecast. These plans assume the use of technologies appropriate to the year in which units are added to the system: circulating fluidized bed units in the 1990s and coal gasificiation combined cycle units after 2000. Capital costs and coal requirements are calculated for cases involving various sulfur dioxide emission targets. A review of these cases indicates that, given emission targets that can reasonably be met by the utilities, given an attractive price for coal and a reasonable capital cost for pollution control technologies, the market potential for coal in this region for electricity production can reach over 10 million metric tonnes/y by 2012. As for exports, given the projected power deficiencies in New England (even taking into account imports to that region from Quebec), and assuming strong regional cooperation and an attractively priced coal supply, it is felt that exports to that region of up to 2,000 MW can be achieved by 2000. In addition, there is the possibility of 500-1,000 MW additional needed coal-fired generation capacity in Newfoundland by 2000, and a similar amount in the Gaspe area of Quebec. 4 figs., 9 tabs.

4598 (CANWEC—1988, pp 52-60) **Development of Quebec's hydroelectric resources and power transmission system.** Mercier, A. (Hydro-Quebec). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper outlines the local demand for electricity in Quebec and describes the Quebec market. Strategies are presented for developing external markets, based on making optimum use of existing and planned interconnections and picking up smaller loads on the Quebec border. Future improvements and new construction of generating facilities indicate an average energy supply of ca 175 TWh/y will be available by 1996. The present power tranmission system is described, consisting of two main axes converging on the Montreal area from James Bay and Churchill Falls. Future planning includes a 450 kV dc line for specific use in power exports, and new 735 kV lines for long-distance power transmission from the new generating facilities. 9 figs., 5 tabs.

4599 (CONF-8608233—3) **Reliability co-ordination in electric power systems.** Valtorta, M.; Manzoni, G. (Ente Nazionale Idrocarburi, Rome (Italy)). Jan 1986. 18p. (In English and French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770064/JAW.

From International conference on large high voltage electric systems; Paris, France (27 Aug 1986).

Given the random nature of hydraulic energy availability and of forced outages of system components (which can cause supply failure), such reliability is evaluated in probabilistic terms through, for example, the probability of supplying peak load, for which a minimum acceptable value is set. The assessment of the optimal reliability level in load supply is a major target in power system planning; this overall level is a function of the reliablity levels at the generation, transmission and distribution stages. Consequently, the most suitable assessment of such levels, i.e. their coordination in relation to the overall level, assumes great importance. The paper shows how it is possible to state the problem and to obtain from its solution the criteria to be adopted for such reliability coordination. In the first step, the problem is solved and the criteria are specified with reference to the simplest system structures, moving from the generation-transmission-distribution cascade. From these results, guidance for seeking the solution of problems related to more complex and detailed structures is obtained.

4600 (CONF-8706352—1) **ENEL (Italian Electricity Board) generation planning: models.** Manzoni, G.; Salvaderi, L. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Jun 1987. 26p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770061/JAW.

From Seminar on comparison of models of planning and operating electric power systems; Moscow, USSR (14 Jun 1987).

The problem of generation system planning, even in the "bus-bar" configuration, is a complex one, since many technical-economical parameters are to be handled at the same time: some of them, moreover, are ruled by random laws and all are mutually interacting. ENEL has devoted, since its foundation, considerable activity to the development of suitable models of generation systems and of their components, as well as, to the relevant computing programs which permit the examination of large systems. Particular attention has been devoted to the quantitative evaluation of system reliability by means of suitable risk indexes (high values of risk indices correspond to low levels of reliability). By assigning a unit cost-of-risk, the overall risk cost constitutes, with capital cost and operating cost, the factors upon which the system optimization is based. The paper describes the main characteristics of the two digital models utilized at ENEL for generation system planning: the WAT program for generation expansion studies and the SICIDR CARTER program for operational planning.

4601 (CONF-8706352—2) **Models used in ENEL (Italian Electricity Board) transmission expansion planning.** Manzoni, G.; Martocchia, C. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Sep 1986. 21p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770062/JAW.

From Seminar on comparison of models of planning and operating electric power systems; Moscow, USSR (14 Jun 1987).

The streamlining of the basic computing programs, utilized for studying the expansion of the E.H.V. transmission network, assumes a very important role as they must necessarily be concatenated to draw from the same data base source and to allow the automatic exchange of data and results from one program to another. This report describes, in detail, two models that, even though utilized by ENEL for many years, nevertheless present some interesting features that have recently received worldwide interest in the design of digital models employed in transmission planning. The first program, named LODEN, explores the probelm of the automatic and optimal expansion of a meshed network spread over many years. It finds application in the long term expansion studies (Strategic Planning) before entering in the detailed studies of power systems. The second program, named SICRET, deals with the problem of an accurate and quantitative evaluation of the static reliability (or adequacy) of the power system. It has been based on the Monte Carlo simulation of a year-long system operation, taking into account various random variables, such as line and generator outages.

4602 **(CONF-8808160—1) Reduction and power losses in transmission and distribution systems.** Herrera, J.I.; Reed, J.H.; Reddoch, T.W. (Oak Ridge National Lab., TN (USA)). 30 Aug 1988. Contract AC05-84OR21400. 24p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002316/JAW.

From Central American and Carribean workshop on electric power: role of demand management and policy issues for independent power generation; San Jose, Costa Rica (30 Aug 1988).

The very real power crisis in many developing countries calls for both innovativeness and efficiency in meeting the needs for electric power posed by social and economic development. One of the key elements in such a strategy is improving the efficiency of electricity transmission and distribution (in other words, reducing unnecessary losses in these parts of a power system). United Nations data, self-reported by individual countries, suggest that average losses in transmission and distribution systems across the region are about 13%. Other data, however, indicate that losses in many countries are on the order of 50% higher than the UN figures; for example, recent data suggest that losses in one country within the region are more than 30%. 22 refs., 8 figs., 3 tabs.

4603 **(DOE/EIA—0226(88/08)) Electric power monthly, August 1988.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 10 Nov 1988. 55p. NTIS, PC A03/MF A01 - GPO. Order Number DE89002942/JAW.

The {ital Electric Power Monthly (EPM)} focuses on the electric utility industry in the United States. Detailed, plant-level data are contained in the {ital Electric Power Quarterly}. More information can be obtained by writing or calling the National Energy Information Center, EI-231, Forrestal Building, Washington, DC 20585, (202) 586-8800. The data in this report are presented for a wide audience including Congress, Federal and State agencies, the electric utility industry, and the general public. The Energy Information Administration (EIA) collected the information in this report to fulfill its data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. Year-to-date 1987 data for sales and prices in previously published issues of the {ital EPM} were preliminary. The 1987 values in this issue are revised Form EIA-826, "Monthly Electric Sales and Revenue Report with State Distributions," data. Final 1987 sales data will be available from the Form EIA-861," Annual Electric Utility Report." 10 refs., 1 fig., 27 tabs.

4604 **(NP—9770075) An integrated software system for planning MV distribution networks.** Fracassi, G.L.; Insinga, F.; Invernizzi, A.; Silvestri, M.; Varlese, F. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Nov 1986. 6p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770075/JAW.

ENEL (Italian Electricity Board) is now loading a database for MV distribution networks. The system is designed to contain, among other data, network topologies, electrical characteristics of network components, load data, costs and geographical coordinates of nodes. In order to perform planning studies on the development of distribution networks, ENEL is working on a computation system, which utilizes the information stored in the data base, the aims: - to provide energy consumption forecasts for each area of the country; - to transfer consumption from each area to the distribution network nodes and to evaluate the electric demand using a statistical power/energy correlation model; - to analyze several development alternatives of the network (new MV/LV transformers, new MV branches, new HV/MV substations) and to select the optimum development plan by comparison of overall costs (investments, operation, risk). The system consists of a set of integrated programs that, in order to make easier its utilization by field engineers, will be operated with interactive and graphic procedures, made available by the use of graphic work stations. The report describes the main objectives and the basic hypothesis assumed to prepare the computation system and its general architecture.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 4313, 4575, 4576, 4577, 4603

4605 (CANWEC—1988, pp 17-22) **A global energy perspective.** Foster, J.S. (Monenco Ltd.). 1988. Canadian National Committee World Energy Conference, Suite 305, 130 Albert Street, Ottawa, Ont., Canada K1P 5G4; $30.00 CAN. (CONF-8710404—; CE—01939).

From 10. Canadian national energy forum; St. John's, Canada (7 Oct 1987).

This paper presents, in graphic and textual forms, the patterns of energy consumption and production from a global perspective. Estimates are made, taking into account the world energy reserves, energy consumption, and forecast energy demand, of future energy prospects. It is seen that current reserves, facilities and infrastructure are at high levels relative to current use, and that global consumption patterns are very unevenly distributed in favor of the more developed areas. 5 figs., 2 tabs.

4606 **(NP—9770025) Baden-Wuerttemberg - energy report 1986/87.** (Ministerium fuer Wirtschaft, Mittelstand und Technologie des Landes Baden-Wuerttemberg, Stuttgart (Germany, F.R.)). 1987. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770025/JAW.

The energy report includes graphs and tables informing about the most important data on the energy supply of Baden-Wuerttemberg in 1986: Development of the primary energy consumption; development of the gross national product and the energy consumption; final energy consumption; resources and utilization of coal, mineral oil, gas, electric power and district heating. The report also provides a general view at the present energy policy of the country in the national and international frame. The annex shows the energy balance of Baden-Wuerttemberg for 1986.

4607 **(NP—9770026) Data on the Bavarian energy supply 1986.** (Bayerisches Staatsministerium fuer Wirtschaft und Verkehr, Muenchen (Germany, F.R.)). 1987. 8p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770026/JAW.

The laparello includes graphs and tables informing about the most important present data on energy supply in Bavaria: Development of the primary energy consumption; changes in the gross national product and the primary energy consumption; final energy consumption; forecast on the primary energy consumption and the final energy consumption until the year 2000; gross power generation by the public power supply; resources and utilization of electric power, gas, mineral oil products and coal; power plant performance, refineries and raw petroleum pipelines in Bavaria.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 4274, 4290, 4291, 4313, 4330, 4366, 4378

4608 **(AC/R—I-503) Engineering and Statistical Research Institute contract reports to May, 1983.** Thuns, A.; Morrison, B.A. (Agriculture Canada, Ottawa, Ontario. Research Branch). Jun 1983. 148p. (CE—01976). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of this publication is to provide information on certain Canadian agricultural research contracts which are completed, published and available for loan. These contracts reports are documentation of research contracted out to non-federal government agencies, universities or individuals. Reports on contracts under the control of the Engineering and Statistical Research Institute are written by the contractor, and are reviewed by the scientific authority. Some reports date back to 1973, when the initial contracting program began. The first program was called DREAM (Development, Research, and Evaluation in Agricultural Mechanization). In 1977-78, projects under the Energy in Agriculture program were added. This was the beginning of the AERD (Agricultural Enginering Research and Development) program. In 1981, energy research had expanded and came under a separate progam called ERDAF (Energy Research and Development in Agriculture and Food). The remaining contract work stayed with the AERD program. This publication lists only contracts completed having final reports, and available contract reports with separate listings sorted by contract file number, title, author or subject.

4609 (CANWEA—8801, pp 316-348) **Marketing under difficult circumstances.** Johnson, D. (Wind Power, Inc., Okotoks, Alta.). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This paper describes experiences and problems of the small wind power producer in Alberta and his relationship to the established electric utilities. Examples are presented of small businesses attempting to commercialize wind power within a framework designed for large utility companies. Experience with utilities, government bodies, and regulatory boards has indicated a lack of encouragement for small power producers interconnecting with existing utility grids. Recommendations are made for improved policies, with government having to take the initiative.

4610 (CANWEA—8801, pp 203-221) **Conference address.** Masse, M. (Energy, Mines and Resources Canada). Jan 1988. Canadian Wind Energy Association, 44A Clarey Avenue, Ottawa, Ont., Canada K1S 2R7; $50.00 CAN. (CONF-8709374—; CE—02009).

From 3. annual national conference of the Canadian Wind Energy Association; Calgary, Canada (27 Sep 1987).

This presentation discusses the role of renewable energy sources as part of Canada's energy supply, and the role of government in promoting development of such energy sources. This role has tended to be in the areas of supporting research and development, and in ensuring fairness in the market by the use of governmental fiscal instruments and incentives.

4611 **(EMR/OERD—68-0/06510) Accomplishments of the New Liquid Fuels Task.** Vancea, L.; Legg, J.F. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Office of Energy Research and Development). Aug 1985. 80p. (CE—01997). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The New Liquid Fuels Task (NLF) is a Canadian program of research and development of those fuels equivalent in use to conventional oil-based fuels. Its objectives include providing alternatives to conventional petroleum, thereby maintaining Canada's energy self-sufficiency. This document describes research and development programs of the NLF in the following areas: direct liquefaction, or the production of liquid fuels from coal, biomass, or mixtures of coal with bitumen, heavy oils and residues; gasification, in which liquid fuels are produced by the indirect liquefaction of coal or biomass in which gasification is an essential step; production of liquid or gaseous fuels from biomass by biological processes; upgrading of synthetic crudes and conversion of natural gas to liquid fuels; fuel use programs, establishing the technical, economic and regulatory basis for deployment of liquid fuels for use in transportation; hydrogen and energy storage, including storage of electricity for use as a transport fuel; study of environmental impacts of new liquid fuels and abatement technologies; and planning and coordination of new liquid fuels research and federal polciy development. Includes lists of contracts and publications. 348 refs.

4612 **(EMR/OERD—8501) Impacts of the federal government budget cuts on the energy research and development sector.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Office of Energy Research and Development). 1985. 64p. (In French). (CE—01969). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

In November 1984, the Canadian government announced important budget cuts to reduce the national deficit. The share of these cuts borne by Energy, Mines and Resources was $613.4 million. Major cuts were made in renewable energy and new energy source programs, and it was felt that these cuts were made without previous analysis of their impact. This document evaluates these impacts from the Quebec point of view, and proposes alternatives for the various levels of government and any other parties concerned. Projects are summarized under the following headings: forest biomass, wind energy, waste heat utilization, urban and industrial biomass, solar energy, hydrogen electrochemistry, and fusion energy. The position of the Quebec goverment in each area is outlined, and recommendations are made for actions which can be suggested to the federal government. 4 tabs.

4613 **(EMR/RE—8307) Renewable Energy Division organization and 1983/84 work.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Renewable Energy Resources Branch). Jul 1983. 29p. (CE—01996). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents, in tabular form, the administrative structure, program tasks, objectives and status of programs, and contract information (if any) of the Renewable Energy Division of Canada's Department of Energy, Mines and Resources. This Division is responsible for overall development and implementation of federal policies and programs in the renewable energy area, and is also responsible for the delivery of some conservation and renewable energy demonstration programs. Information is presented for the Renewable Energy Policy Section, Biomass Policy Section, Demonstration Section, and Renewable Energy Programs Section. 5 figs., 1 tab.

4614 **(PNL—6713) Wood stove use in the end-use load and consumer assessment program residential base sample.** LeBaron, B.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 50p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004002/JAW.

This report examines wood heating in the End-Use Load and Consumer Assessment Program (ELCAP) Residential Base Sample during the 1985/1986 heating season. The goals of this study were to assess the frequency of wood burning in homes having wood burning equipment and to estimate the quantity of electrical space heat displaced by it use. 15 refs., 18 figs., 6 tabs.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

4615 (ANL/MHD—88-1) An evaluation of corrosion behavior of materials for application in an MHD steam bottoming plant. Natesan, K. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 35p. NTIS, PC A03/MF A01. Order Number DE89001030/JAW.

Test data have been developed for the corrosion of several commercial ASME-coded alloys and their weldments by exposing internally cooled ring specimens to simulated magnetohydrodynamic (MHD) environments. The specimens, coated with a K_2SO_4-rich deposit, were exposed for times up to 2000 h at metal temperatures of 762 and 593{degree}C to simulate intermediate-temperature air heater and transition region conditions, respectively. The gas temperatures in these tests were 982 and 816{degree}C, respectively. This report discusses, in detail, the observed corrosion scale morphologies of various exposed specimens. Data on scale thickness, depth of intergranular penetration, and metal recession are presented and the results are used to assess the corrosion behavior of various materials for application in MHD steam bottoming plants. 8 refs., 28 figs., 5 tabs.

4616 (CESI—86-1) Preliminary study for 20 MWe MHD retrofit of an Italian industrial cogeneration plant. Repetto, F.; Buccianti, R.; Thione, L.; Bellofatto, O.; Di Meglio, A. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Jan 1986. 16p. (CONF-8601146—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770042/JAW.

From International workshop on fossil fuel fired MHD retrofit of existing power stations; Rome, Italy (1 Jan 1986).

The retrofitted boiler is one of the four 270 t/h superheated steam boilers. The existing steam generator is able to work in connection with MHD generator since it has two tubepitches in the convection zone, thus allowing the cleaning of the exchanging surfaces which are convered by the seed deposited on them. The steam produced during the operation is used not only for electrical power generation but also for process uses. The boiler thermal input, at maximum continuous rating (m.c.r.), is equal to 200 MWt. To permit a homogeneous comparison, it is assumed that, in the new condensing steam turbine, a net power of 68 MW is produced by means of a steam flow of 270 t/h (200 MWt), with an efficiency of about 34%. With the MHD section, the efficiency can be increased up to 38%. The results of the study show that a 38% overall efficiency can be achieved with reference to the following values of the most important process parameters: - combustion air preheating temperature 1700 degrees Celsius; - air enrichment by oxygen (by volume) 23%; - maximum magnetic field induction 6 T; - combustion chamber pressure 6 bar; - boiler feedwater preheating temperature (feedwater is heated by MHD channel and diffuser) 230-250 degrees Celsius. With these values of the previous parameters, the gross electrical power produced by the MHD generator (in addition to the 68 MW produced by the equivalent turbogenerator) is equal to 33 MWe. The use, considered in this technical-economical feasibility study, of natural gas as a primary source does not represent a strategic option for such power plants.

4617 (DOE/PC/90255—T3) Coal-fired MHD combustor development project: Phase IV, Fifth quarterly technical progress report, November 1, 1987 through January 31, 1988. (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.). Sep 1988. Contract AC22-87PC90255. 109p. (MHD-IV—88-083). NTIS, PC A06/MF A01. Order Number DE89002169/JAW.

This progress report presents the accomplishments during the period February 1, 1988 to April 30, 1988. The scope of work covered by this quarterly report encompasses primarily coal-fired precombustor testing, CDIF data analysis, and cold-flow modeling. Progress during this reporting period is summarized: (1) A total of 23 tests of the coal-fired precombustor were conducted at TRW. Heat losses ranged from 1.1--1.3% for the precombustor, 5.0--7.3% for the first stage, and 2.1--2.5% for the second stage. Slag recovery improved to 65--90%. Average conductivity of 7.0--8.1 mho/m was 80--90% of theoretical predictions. (2) Nine hot-fire tests were conducted at the CDIF to investigate the effects of different second stage oxidizer injection configurations on power train performance. These changes have resulted in a 40% increase in power output. (3) Evaluation of combustor/power train data continued, with the focus on assessing the impact of second stage configuration changes on voltage and current characteristics and boundary layer effects in the channel. (4) Cold-flow modeling studies were performed to investigate oxidant mixing in the second stage and seed distribution in the exit section. 38 figs., 11 tabs.

4618 (DOE/PC/90255—T4) Coal-Fired MHD Combustor Development Project: Phase 4: Fourth quarterly technical progress report, November 1, 1987--January 31, 1988. (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.). Sep 1988. Contract AC22-87PC90255. 58p. (MHD-IV—88-033). NTIS, PC A04/MF A01. Order Number DE89002170/JAW.

This fourth quarterly technical progress report of the Coal-Fired MHD Combustor Development Project (Phase IV) presents the accomplishments during the period of November 1, 1987 to January 31, 1988. The scope of work covered by this quarterly report encompasses acquisition of coal-fired precombustor and continuous slag rejector hardware, repair/replacement of coal-fired combustor components, coal feed system testing, preparations for coal-fired precombustor testing, and power train testing/performance analysis. Progress during this reporting period is summarized. 14 figs., 5 tabs.

4619 (DOE/PC/90255—T5) Coal-Fired MHD Combustor Development Project: Phase 4: Third quarterly technical progress report, August 1987--October 1987. (TRW Space and Technology Group, Redondo Beach, CA (USA). Applied Technology Div.). Sep 1988. Contract AC22-87PC90255. 73p. (MHD-IV—87-194). NTIS, PC A04/MF A01. Order Number DE89002171/JAW.

This third quarterly technical progress report of the Coal-Fired MHD Combustor Development Project (Phase IV) presents the accomplishments during the period of August 1 to October 31, 1987. The scope of work covered by this quarterly report encompasses acquisition of coal-fired precombustor and continuous slag rejector hardware, repair/replacement of coal-fired combustor components, coal feed system fabrication/test setup, and power train testing/performance analysis. Progress during this reporting period is summarized. 15 figs., 9 tabs.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 4241

3005 Fuel Cells

4620 Overview of the U.S. fuel cell program. Hagey, G.L. (Department of Energy, Washington, DC (USA)). pp 2-9 of Fuel cell technology and applications. Utrecht, Netherlands; Management Office for Energy Research PEO (1987). (CONF-8710316—).

From Fuel cell seminar; Hague, Netherlands (26 Oct 1987).

The current research and development activities, new fuel cell concepts and possible early markets for fuel cell systems in the United States are summarized. Development activities include alkaline, polymer, phosphoric acid, molten carbonate and solid oxide electrolyte fuel cells. 1 fig., 12 refs., 1 tab.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 4228, 4567, 4578, 4585, 4614, 4666, 4679, 5228

4621 **(ARCA—ERRF32-13) The attachment of roof insulation to existing built-up roofs. Supplementary report to final report of August, 1981.** (Alberta Roofing Contractors Association Ltd., Calgary (Canada)). Dec 1983. 14p. (CE—01981). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents results of a test program on the retrofitting of thermal insulation onto flat roofs in Alberta using foamed-in-place polyurethane. Problems with the technique are described, and include the shrinkage, loosening and blowing off of Fabrene covering, loosening of the insulation from the roof floodcoat, blowing of insulation off the roof due to high winds, poor appearance of the roof, and deterioration of the polyurethane. It was concluded that this type of program is not practical. 26 figs.

4622 **(BCICA—1987) Quality standards for mechanical insulation (commercial and institutional buildings).** (British Columbia Insulation Contractors Association, Burnaby (Canada)). 1987. 94p. (CE—02007). British Columbia Insulation Contractors Association, #242 - 4299 Canada Way, Burnaby, B.C., Canada V5G 1H3; $N/C.

The intention of this manual is to provide specification standards for quality performance of thermal and acoustic insulation systems where used on heated and cooled mechanical systems in commercial and institutional buildings. The standards contained within the manual are based on current and accepted provincial trade practices in British Columbia, and on the use of reputable materials in regular supply in the province which are, as far as can be determined from the data available, within the same price range. Technical data are provided only on the most commonly called for performance criteria for insulation materials, i.e. density, use limits (temperature), flame spread rating, and smoke developed classification. Separate sections of the manual cover piping, ductwork and plenum, equipment, standard formats for specifications, asbestos removal, firestopping and smoke seal systems, and periodic inspection and maintenance recommendations. Includes glossary. 1 ref., 4 tabs.

4623 **(BNL—41877) Alternative venting methods for residential oil heating systems.** Batey, J.E.; McDonald, R.J.; Butcher, T.A. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 15p. (CONF-880679—12). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003155/JAW.

From 81. annual meeting of Air Pollution Control Association; Dallas, TX, USA (1 Jun 1988).

Alternative exhaust gas venting methods in place of conventional chimney venting may present many important advantages, including: Improved indoor air quality, improved overall heating system efficiency and reduced fuel use, lower installation costs for oil heat systems, and expanded markets for new efficient oil heating equipment. However, a number of key technical issues must be addressed and resolved before alternative systems can be widely implemented. This paper presents an overview of conventional chimney venting techniques including a review of operational problems. These include induced outdoor air infiltration into the building and undesired transient effects that can increase soot and incomplete combustion product emissions, and increase annual fuel use. Alternative venting methods are introduced and some important operational advantages are discussed. Finally, research design and development activities needed to successfully apply alternative venting options are discussed. 2 refs., 13 figs.

4624 **(CMHC—83) The technique used in CMHC-2 (Computer Model for Heating Cost Effectively) to model outdoor temperature data.** Parsons, L.J.; Webster, D.W. (Canada Mortgage and Housing Corp., Ottawa, Ontario). [1983]. Vp. (CE—01991). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The CMHC-2 (Computer Model for Heating Cost-effectively) program evaluates a dwelling's heat loss due to the time varying outdoor dry bulb temperature. For this analysis a correlation was developed which provides an accurate, simple, and comprehensive definition of the indoor to outdoor temperature difference, integrated over time. Conventional techniques, including published degree days, mean monthly temperatures, the bin method and an hourly analysis were evaluated and dismissed. The chosen technique uses one equation to define the long-term effective temperature difference for each month. Further, the proposed correlation has significant potential for improving the accuracy and speed with which all energy calculations (including cooling loads) can be performed. 4 refs., 6 figs., 1 tab.

4625 **(CONF-880287—Summs.) US Department of Energy radon forum: Meeting notes.** Duray, J.R. (ed.). (UNC Geotech, Grand Junction, CO (USA). Technical Measurements Center). Aug 1988. Contract AC07-86ID12584. 305p. NTIS, PC A14/MF A01. Order Number DE89001183/JAW.

From U.S. Department of Energy radon forum; Grand Junction, CO, USA (24 Feb 1988).

The Radon Forum was conceived as an intradepartmental exchange of information about radon research and applications. The Department of Energy has for some time been studying radon, its consequences, and methods for dealing with radon in its various programs. A Radon Forum was judged the best means to update Department Offices involved with radon, to promote efficiency in planning and conducting programs, and to aid the coordination of future work. Over the course of two days during February 1988, six Department Offices summarized their current programs with the emphasis on radon involvement. These Meeting Notes are intended to present an overview of the proceedings to those who did not attend and to recall the presentations to those who did. Although many of these pages are reproductions of the visual presentation materials used by the participants, they are to a large extent self-explanatory. The last session consisted of a Commentary and Open Discussion among the participants. The participants synthesized the presentations and discussed the recommendations summarized by the Facilitator, Professor Frank Parker. No claim of breakthroughs was made during the Radon Forum. Each report contains only an abstract and viewgraphs.

4626 **(CONF-880872—6) Statistical analysis applies to energy conservation programs.** Hwang, Ho-Ling; Miaou, S.P. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 26 Oct 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89003130/JAW.

From Joint statistical meetings; New Orleans, LA, USA (22 Aug 1988).

The PRInceton Scorekeeping Method (PRISM) has been widely used in energy conservation studies. The method uses a simple regression model which yields meaningful and easy to understand physical interpretations. PRISM uses readily available data to produce weather-adjusted measures of energy consumption. It allows researchers to perform comparisons of conservation program effectiveness across geographical locations and periods of time. The accuracy of PRISM estimates for space heating energy use and base load energy use, however, are still uncertain. This paper describes the statistical techniques employed in the research conducted at Oak Ridge to improve the accuracy of PRISM estimates. Data collected from the Hood River Conservation Project (HRCP) was used in this study. Results from the analyses are presented. 11 refs., 2 figs., 1 tab.

4627 **(CONF-8804100—) Proceedings of the 2nd DOE/ ORNL heat pump conference: Research and development on heat pumps for space conditioning applications.** (Oak Ridge National Lab., TN (USA)). Aug 1988. Contract AC05-84OR21400. 225p. NTIS, PC A10/MF A01. Order Number DE89001392/JAW.

From 2. DOE/ORNL heat pump conference: research and development on heat pumps for space conditioning applications; Washington, DC, USA (17 Apr 1988).

This conference was planned to provide information on current R&D activities on residential and commercial heat pumps in the US Department of Energy (DOE) and Oak Ridge National Laboratory (ORNL) Building Equipment Research (BER) Program. It was primarily for the benefit of HVAC equipment manufacturers who could use the technology in future products, but was also of value to a wider audience, including utilities, independent R&D organizations, universities, other government groups, and research funding and management organizations. Because this conference was intended to be a significant part of our technology transfer efforts, the presentations emphasized energy performance objectives, technical results, development status, and potential HVAC equipment applications. In addition, the conference was organized to facilitate information exchange among attendees, speakers, and the DOE and ORNL Program staff, and to create an opportunity to receive constructive input from the private sector. The technical presentations were grouped into two principal subject areas: electric heat pump technology and thermally activated heat pump systems. Electric heat pump topics included capacity modulation experiments and system design analysis development, nonazeotropic refrigerant mixtures, and ground-coupled systems. In the area of thermally activated heat pumps, presentations centered on the development of absorption systems, engine-driven heat pumps, and Stirling engine-driven heat pumps.

4628 **(CONF-8809142—2) Use of metered data analysis to improve building operation and maintenance: Early results from two federal complexes.** Haberl, J.S.; Vajda, E.J. (Management Information Support, Lakewood, CO (USA)). 1988. Contract FG01-88CE27489. 15p. NTIS, PC A03. Order Number DE89002504/JAW.

From American Council for an Energy Efficient Economy conference; Pacific Grove, CA, USA (3 Sep 1988).

Metered data analysis of a building's energy consumption is rapidly becoming a vital part of an energy audit. Approaches used vary depending on the purpose of the analysis, the availability, level of detailed information, and the complexity of the building being considered (MacDonald and Wasserman, 1987). One approach, adapted from a university prototype, has been shown to be capable of identifying operation and maintenance problems by comparing actual energy consumption with normalized energy consumption (Haberl, 1986). This idea, the use of a comparative model to detect abnormal behavior, is at the very heart of intelligent diagnostic systems (Richardson, 1985). A fully developed system has the capabilities of providing continuous monitoring and expert-level diagnostics for complex building energy systems. This paper discusses the application of such an approach to two federal complexes. 23 refs., 16 figs., 1 tab.

4629 **(CONF-8810134—4) Radon diagnostics: Subslab communication and permeability measurements.** Matthews, T.G.; Wilson, D.L.; TerKonda, P.K.; Saultz, R.J.; Goolsby, G.; Burns, S.E.; Haas, J.W. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003409/JAW.

From Symposium on radon and radon reduction technology; Denver, CO, USA (17 Oct 1988).

Mathematical models are developed from Darcy's Law to determine the permeability of soil and subslab soil/gravel media. Three geometrical configurations have been applied as boundary conditions: a spherical geometry for soil tube measurements, a hemispherical geometry for subslab measurements in the absence of a gravel layer, and a cylindrical disk geometry for subslab measurements in the presence of a gravel layer. A power dependence on pressure is included in all three models to investigate potential nonlaminar air flows. The results of extensive permeability studies at six Tennessee Valley homes are fit to the models using non-linear regression analysis. All three models yield an average exponent of about 0.7 for the pressure term, indicating some degree of nonlaminar flow. Subslab permeabilities and induced pressure field radii are almost always increased by installation of gravel-filled pits as part of the subslab ventilation system. In a house with no pre-existing subslab gravel layer, order of magnitude increases in permeability and extensions in pressure field radii were observed. The subslab permeability at selected sites in this house also exhibited a strong depth dependence because of hard clay and soil layers within the first 150 cm beneath the slab. In houses with pre-existing subslab gravel layers, installation of mitigation pits resulted in no change to threefold increases in permeability and extensions in induced pressure field radii. These findings are supported by the mathematical forms of the hemispherical and cylindrical disk models. 9 refs., 2 figs., 4 tabs.

4630 **(DOE/BP—1031) Construction cost analysis for the Residential Construction Demonstration Project: Cycle 1.** Barnett, C.; Reiland, P.; Thor, P. (Bonneville Power Administration, Portland, OR (USA)). Jul 1988. 162p. NTIS, PC A08 - OSTI. Order Number DE89003509/JAW.

This paper reports on the incremental costs of some of these new building techniques on 152 homes participating in the project. In this report, we examine the costs associated with building energy- efficient homes using real data compiled by builders and their subcontractors. Energy data will be presented in a different report. 3 figs., 17 tabs.

4631 **(DOE/BP—1098) The Residential Standards Demonstration Program solar access report.** Johnson, M.E. (USDOE Bonneville Power Administration, Portland, OR. Office of Conservation and Power Resources). Dec 1987. 49p. NTIS, PC A03 - OSTI. Order Number DE89003506/ JAW.

This paper reports the results of analysis performed on solar access data collected on 788, out of 835, single-family residences that participated in the Residential Standards Demonstration Program (RSDP). The data were analyzed by State, climate zone, and Model Conservation Standards (MCS) vs. control homes. 11 figs., 7 tabs.

4632 **(DOE/CE—0223-Vol.2) Technical support document: In support of interim energy conservation standards for new federal residential buildings.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Buildings and Community Systems). Jun 1988. 709p. NTIS, PC A99/MF A01 - OSTI. Order Number DE89004114/JAW.

This document provides the technical documentation for the Conservation Optimization Standard for Savings in Federal residences (COSTSAFR) computer program. This computer program has been developed as part of a DOE-sponsored effort to develop the proposed interim Energy Conservation Standard for Federal Buildings. This project was a cooperative effort of Pacific Northwest Laboratory (PNL), Steven Winter Associates, Inc. (SWA), and Wright Associates. Related documentation for the standard includes a User's Manual, the actual software, an environmental assessment, an economic assessment or regulatory impact statement,and the Notice of Proposed Rulemaking. The Standard establishes minimum allowable energy consumption levels for new housing procured by the Federal Government. These levels are based on a Life Cycle Cost Analysis, which is performed on location-specific and building-specific energy data bases, and on building-specific cost data bases. 2 figs., 50 tabs.

4633 **(DOE/OSTI—11628/2) Office of Buildings and Community Systems: FY 1986 research in progress.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Buildings and Community Systems). Sep 1988. 48p. NTIS, PC A03/MF A01. Order Number DE88006580/JAW.

This report was compiled for the Office of Buildings and Community Systems from project summaries contained in the Research-In-Progress (RIP) data base of the Office of Scientific and Technical Information, Oak Ridge, Tennessee. The RIP data base

describes new and ongoing energy and energy-related research projects carried out or sponsored by the Department of Energy.

4634 **(LBL—20541) Definition and use of a daylight "coolness" index.** Arasteh, D.; Johnson, R.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). Nov 1986. Contract AC03-76SF00098. 12p. (CONF-861109—2). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002919/JAW.

From 2. international daylighting conference: architecture and natural light; Long Beach, CA, USA (5 Nov 1986).

This paper examines the relationship between lighting energy savings from daylighting and daylight-imposed cooling loads. From DOE2.1C simulation results for specific commercial buildings and glazing options, we show that for any daylighted or electrically lighted space, the cooling load component from natural or artificial lighting can be broken into three component factors. Each of these factors can be expressed mathematically as constants that are a function of glazing characteristics and illumination levels within the space. These three constants can then be combined into a single daylight coolness index. Thus, from (model or simulation) illuminance measurements for a proposed daylighted space, a designer can quickly compare the relative cooling load impacts of different daylighting designs. 13 refs., 4 figs., 1 tab.

4635 **(LBL—25525) Planning for an energy-efficient future: The experience with implementing energy conservation programs for new residential and commercial buildings: Volume 1.** Vine, E.; Harris, J. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 101p. NTIS, PC A06/MF A01. Order Number DE89002490/JAW.

This report is one of a series of program experience reports that seek to synthesize current information from both published and unpublished sources to help utilities, state regulatory commissions, and others to identify, design, and manage demand-side programs. This report evaluates the experience with implementing programs promoting energy efficiency in new residential and commercial construction. This investigation was guided by our perspective on how programs address the barriers to widespread adoption of energy-efficient design and better end-use technologies in new buildings. We considered four types of barriers: lack of information, high initial costs, degree of technological development, and perceived risk. We developed a typology that reflects different approaches to overcome these barriers to energy-efficient construction. 234 refs., 5 tabs.

4636 **(LBL—26196) The compatibility of energy conservation and indoor air quality.** Grimsrud, D.T.; Turk, B.H.; Prill, R.J.; Revzan, K.L. (Lawrence Berkeley Lab., CA (USA)). Oct 1988. Contract AC03-76SF00098. 24p. (CONF-8810163—2). NTIS, PC A03/MF A01. Order Number DE89002307/JAW.

From Soviet-American symposium on energy conservation research and development; Yalta, USSR (6 Oct 1988).

Two studies of indoor air quality in residences are described. In the first air quality measurements are reported in 111 unweatherized houses followed by careful observation of changes in ventilation rates and air quality in a subset of forty of the houses that received staged weatherization. A large fraction of the houses sampled in the eastern portion of the state of Washington contained high concentrations of radon gas. The major change in air quality seen in the sample as the result of weatherization was a substantial decrease in radon concentration in houses having crawlspaces. A second study reported compares ventilation and air quality in 62 new residences. Half were built using Model Conservation Standards to promote energy efficiency; the other half were built using conventional techniques for the region. Little difference was seen in ventilation rates in spite of significant design differences. Larger variations in air quality were seen between houses in different regions than between the Control and test houses in the same region. We conclude that changes in housing design and construction to promote energy efficiency are not incompatible with good indoor air quality. 20 refs., 13 figs.

4637 **(LBL—26252) Ventilation strategies for non-residential buildings.** Feustel, H.E. (Lawrence Berkeley Lab., CA (USA)). Jul 1987. Contract AC03-76SF00098. 11p. NTIS, PC A03/MF A01. Order Number DE89003039/JAW.

Ventilation in nonresidential buildings in the United States of America has been traditionally provided by means of mechanical ventilation. The ventilation systems have been designed for the maximum load possible for the building and have been used accordingly. The maximum load for a lot of the nonresidential buildings is determined by the amount of ventilation air intake based on the total occupancy rather than by heat transfer through the building's envelope. Tremendous savings are possible by adjusting the outside air flow according to occupancy of the building, especially for buildings with changing rates of occupancy. In most cases, another potential savings can be experienced just by adding heat recovery devices to the existing air handling system. Heat recovery options using a heat pump to heat domestic hot water should be considered for all-electric buildings with a high hot water consumption. Although a number of strategies to save energy have been discovered, none work well for all possible applications in the different climates to be found in the US. A more detailed investigation applying all the possible strategies for a number of building types in all major climates should follow this study. 6 refs., 5 tabs.

4638 **(NECA—1988) Windows. Bulletin 1. Technical report.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). [1988]. 28p. (In English and French). (CE—02017). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $N/C.

This review of current window technology begins with an outline of the performance classification levels of the Canadian national standard. Heat losses through windows by conduction, convection and radiation are discussed, giving data on typical percentages of total annual space heating energy losses for Canadian conditions. Typical thermal resistance figures are given for various types of windows, and the effect of additional panes and air spaces is reviewed. The conditions that can lead to condensation on windows are addressed. Advanced windows, such as those using low emissivity films, non-air fill gas, convection suppression systems, and multiple glazings are evaluated. Predicted and published data are presented on the thermal performance of such windows, and their economic performance briefly assessed. Air infiltration test results are given for about 80 different window types. Includes glossary. 6 refs., 6 figs., 7 tabs.

4639 **(NECA—1988) Air sealing. Bulletin 1. Technical report.** (National Energy Conservation Association, Winnipeg, Manitoba (Canada)). [1988]. 28p. (In English and French). (CE—02018). National Energy Conservation Association, Suite 620, 5 Donald Street, Winnipeg, Man., Canada R3L 2T4; $N/C.

Air sealing has become a very crucial step in the building and retrofitting of houses in Canada, for reasons of preventing heat losses, improving comfort, and controlling humidity. This document reviews the various aspects of air infiltration and air quality in houses, and discusses methods to avoid or reduce problems due to those factors. Sources of indoor moisture are indicated, and air sealing is recommended as a way of controlling both the heat losses from air infiltration and the diffusion of water vapor into the building. Other benefits from air sealing include improved energy efficiency and comfort and reduction in condensation on windows. Also discussed is the effect on air flow of residential combustion appliances. Proper supply of combustion air is emphasized, and ways of ensuring such supply to furnaces and other appliances are described. 7 refs,, 6 figs., 1 tab.

4640 **(NP—9770027) Determining the dehumidification time for new buildings from the viewpoint of the development of damage caused by humidity and with consideration of hitting rain and the influence of airtightness of modern windows.** Steinert, J. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Baustoffe, Massivbau und Brandschutz). Apr 1987. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE89770027/JAW.

The aim of this research project was to determine the dehumidification time for walls and to find a coherence between drying building humidity and the air exchange neccessary to avoid damage caused by humidity in new buildings. Measurement results about internal climate, external climate and gravimetric humidity determination are presented. Furthermore, following additional investigations are reported on: Determination of the humidity of building materials from the relative air humidity; dehumidification of gas concrete internal walls; alteration of the relative air humidity in rooms by means of dehumidifying building parts. To make the dehumidification of new buildings easier it is recommended to build in the windows without a scaling and to make them airtight only later, for example after one year. To ensure sufficient dehumidifcation, the air humidity should be recorded. (HWJ).

4641 **(NP—9770055) Air/water source heat pumps for water heating in residential buildings.** Botta, G.; Lembo, E. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Apr 1987. 101p. (In Italian). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770055/JAW.

This report describes technical and operational characteristics of small heat pumps for water heating. Air/water heat pumps, coupled with a suitably sized tank for the hot water requirements of one to two families, are considered. The heat pump cycles and main components of these devices are briefly described. Advantages and problems arising in domestic use are then discussed. Experimental data obtained in laboratory tests are also reported. Among these, performance data collected after long term hot water production (more than two years) are of special interest. Energy performance and consumptions are analysed and possible savings with respect to other systems, in particular, resistance heaters, are assessed.

4642 **(NP—9770092) Optimisation of passive and hybrid solar energy utilisation in three projects.** Binz, A.; Guetermann, A. (Bundesamt fuer Energiewirtschaft, Bern (Switzerland); Nationaler Energie-Forschungs-Fonds (NEFF), Basel (Switzerland)). Feb 1986. 204p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770092/JAW.

Under the terms of a research programme on passive and hybrid solar energy utilisation (reduction of heating energy requirement), three construction projects were followed continuously through their design and planning stages. Each case is presented in a separate chapter. A general discussion is given of the project, the idea of the project, its development, computer-aided study of parameters, veranda design, insolation through the south-facing window, construction and details of the shell of the building, coverage of remaining thermal requirement, comment by the architect. The information gained from this experiment relates to gaps in knowledge, problems of communication and terms of reference. Particular emphasis is placed on the demonstration effect of this project. (HWJ).

4643 (NP—9770092, pp 15-72) **Project 1: Semi-detached houses in Wald (ZH).** Binz, A.; Guetermann, A. Feb 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770092/JAW.

In Optimisation of passive and hybrid solar energy utilisation in three projects.

Research into passive and hybrid solar energy utilisation was conducted in semi-detached houses (positioned on a steep south-west facing slope). Each of the main storeys has an unheated, fully-glazed veranda porch. The report covers the project idea and development, (embedding the building in the earth, zoning, glazed veranda, optimation, insulation) using floor plan sketches and tables of specification data. Computer-aided parameter studies (model, thermal insulation, quality of glazing, fresh air, buffer zones) follow, with construction hints on the design of the glass veranda (many sectional drawings, heat bridges) and the coverage of the remaining heat requirement (design + planning of electrical + heating installations, several alternatives). The architect's comments on the solar concept and his correct zoning of the house conclude the article.(HWJ).

4644 (NP—9770092, pp 73-147) **Project 2: Duplex (terraced) housing in Schuepfen (BE).** Binz, A.; Guetermann, A. Feb 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770092/JAW.

In Optimisation of passive and hybrid solar energy utilisation in three projects.

As part of a duplex housing scheme, conceptional ideas for passive solar energy utilisation in a middle house were considered. Using floor plan sketches and house specifications, a sort of modular system is reported, in which not only south-facing windows, but also air collectors and a conservatory are included. Efforts at optimation were directed to the air collector with a vertical latent storage unit, improvements in the thermal insulation of the shell, window areas (reduction) and heat recovery from exhaust air. By means of computers, 33 variations for direct gains, conservatory and air-collector were studied (diagrams and tables). A microcomputer is recommended to the architect as an intstrument for optimation (optimation steps explained). Further details are given on the strategy of solar energy utilisation (reduction of heat requirement, energy gains from windows, conservatory and collector). The optimation of the collector system is discussed in more detail, and the coverage of the remaining heat requirement is gone into. The architect's comments conclude the article. (HWJ).

4645 (NP—9770092, pp 149-192) **Project 3: Apartment block housing in Preverenges (VD).** Binz, A.; Guetermann, A. Feb 1986. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE89770092/JAW.

In Optimisation of passive and hybrid solar energy utilisation in three projects.

Due to the importance of optimizing passive solar energy utilization for single-family housing, especially with reference to the Swiss housing inventory, more precisely-conducted experiments on the project were done. The building project was made up of duplex and apartment housing units with some semi-detached. The plan was to have glazed veranda porches, living rooms 'producing waste heat' (division into zones), glazed buffer-zones and energy-links between the north and south verandas. Computer-aided simulation of the thermal budget (direct gains, glazed veranda) follows, and also construction details of the building shell (sectional drawings of walls, concrete cavity wall construction). The remaining thermal requirement is covered by gas-fired systems and underfloor heating. In conclusion, the architect comments on aspects and philosophical questions of solar energy. (HWJ).

4646 **(NP—9770093) Results of experiments on a transparent thermal insulation for a house facade.** Pflueger, A.; Platzer, W.; Schmidt, J.; Stahl, W.; Wittwer, V. (Fraunhofer-Institut fuer Solare Energiesysteme (ISE), Freiburg im Breisgau (Germany, F.R.)). [1987]. 15p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770093/JAW.

Experiments with transparent thermal insulation (TTI) were carried out on a single-family house with several floors. Temperatures were measured under the transparent thermal insulation of the facade, which was painted black, on white segments of the facade, the outdoor air, inside the building behind the facade with TTI, on the heat flow panels in the part of the facade painted black and on the western external wall (vertical insolation). Results of experiments with an acrylic system and with a capillary material are given with and without shade. It is considered possible to achieve zero transmission losses with further improved TTI systems on a facade. However, with energy prices at their present level, long amortisation periods must be expected for TTI systems. (HWJ).

4647 **(NP—9770097) Experimental study of energy absorbers. Measurement of energy absorbers manufactured by Hoesch.** Boeck, H.; Lessmueller, E.; Sauer, H.D.; Schoelkopf, W. (Muenchen Univ. (Germany, F.R.). Lehrstuhl fuer Experimentalphysik). Nov 1984. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770097/JAW.

During July 1983 and July 1984 the thermal capacity of energy absorbing heat exchangers (energy absorbers) manufactured by Hoesch was measured. These detailed measurements were carried out at the collector test facility of the University of Munich, Federal Republic of Germany. The thermal performance was determined following an extensive test program taking into account different operating modes and weather conditions. These tests were complemented by laboratory measurements of pressure drop and flow rate inside the absorber plate using infrared thermography. The meteorological data and measured values were recorded and evaluated by means of a process computer. (ALE).

4648 **(NP—9770098) Reflections on the economic aspects of LEGIS.** Kaiser, N. (Fraunhofer-Institut fuer Solare Energiesysteme (ISE), Freiburg im Breisgau (Germany, F.R.); Kaiser Bautechnik Ingenieurgesellschaft m.b.H., Duesseldorf (Germany, F.R.)). [1987]. 6p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770098/JAW.

LEGIS construction elements are used for wall-cladding. Their cost efficiency depends largely on the way they are used and the possibility of mass-production. The acceptable method of application for LEGIS from the architectural point of view (with the advantages of low energy-consumption) was illustrated in the practical example of a simple single-family house (several house designs). These house types were then optimised with regard to the slope of the house wall in relation to the angle of insulation in the most unfavourable month. The saving in heating energy attributable to the LEGIS system is stated. The overall observation is that LEGIS can be applied cost-efficiently at present. (HWJ).

4649 **(NP—9770099) Design and dimensioning for a low-energy house with minimal heating requirements.** Reichmann, J. (Fraunhofer-Institut fuer Solare Energiesysteme (ISE), Freiburg im Breisgau (Germany, F.R.)). [1987]. 24p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770099/JAW.

A type of house in presented which was largely industrially manufactured (prefabricated construction) with noteworthy energy efficiency as its outstanding feature. It has been mathematically demonstrated that the heat consumption of this house can be reduced to almost zero by means of structural, measures (solar architecture) linked with a clever combination of LEGIS walls, windows, opaque thermal insulation and heat storage. More precise details are given with building drawings and diagrams on the usability of solar energy gained in housing buildings and on the energy balance of windows (improving the k-value in glazing) and LEGIS external wall facings (thermal flows). In conclusion, the report covers the calculation of heat consumption in this LEGIS experimental house (design of external walls, calculation, heat physiology). It makes clear just how much energy-saving potential can be exploited by utilising solar energy consistently. (HWJ).

4650 **(NP—9770100) Heating energy savings by using walls with transparent thermal insulation layers - computation results for idealized, internal marginal conditions. Interim report.** Schreiber, E.; Boy, E.; Bertsch, K. (Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.). Bereich Waerme/Klima). 1985. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770100/JAW.

In mathematical parameter studies, the material and application-related influences on its performance were analysed on a transparent insulation - clad wall model under idealised internal boundary conditions. They showed that the effective annual average k-value of the wall construction with transp. insulation is considerably below its own k-value at only radiation transmission levels of 0.3 or more and equivalent thermal conductivity values below 0.08 W/mK. By kontrast with opaque insulation, however, it is not possible in every case to improve the effective k-value by increasing the thickness of the layer with transparent insulation. A significant dependency on the quotient of total insolation and heating level days was also identified. The overall result of these studies was to show that transmission losses from outside walls can be greatly reduced with transparent thermal insulation. Because of the dependency on thickness of the radiation transmission efficiency, there exist an 'optimum' thickness. (HWJ) With 4 tabs., 13 figs.

4651 **(NP—9770101) Thermal stress on wall constructions with transparent thermal insulation layers in summer and winter - measuring results on different marginal conditions. Interim report.** Boy, E.; Lang, H.; Bertsch, K. (Fraunhofer-Institut fuer Bauphysik, Stuttgart (Germany, F.R.). Bereich Waerme/Klima). 1987. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770101/JAW.

Experiments to study solid external walls with cladding made of transparent material identified the dependency of the thermal behaviour on various influence factors. The authors discuss the way in which transparent insulating layers work on solid outside walls (reduction of heating energy consumption, solar radiation, radiation intensity, temperature amplitude narrowing, transmission heat losses, heat flow density) and thermal stress on wall constructions with a transparent insulating layer (experimental structures, climatic boundary conditions). The research results are set out, and concern the influence of the wall building-material (heat transition coefficient, lightweight bricks, lightweight calcareous sand bricks, hollow pumice-stone bricks, normal concrete), of the insulating layer (k-value, radiation transmission efficiency, thermal behaviour, surface temperature), and of orientation (south, east, west-facing, thermal stress of wall construction, annual curve). Temperatures of up to 100/sup 0/C can occur on highly-insulating lightweight wall constructions, which are too high for the insulating material to withstand. (HWJ) With 16 tabs., 8 figs.

4652 **(NRC/BR—83) The use of electricity in Canadian houses by non-space heating appliances.** Webster, D.W. (National Research Council of Canada, Ottawa, Ontario. Div. of Building Research). 1983. 8p. (CE—01990). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The results of a Canada-wide survey of provincial utilities to determine residential electrical consumption for appliances, lights and domestic hot water are provided. The surveys were undertaken to support the analysis and database requirements for electrical energy usage in the CMHC-2 program to assist in making a more precise analysis of energy performance (space heating, domestic water heating and appliance use). The average Canadian electrical energy consumption for domestic hot water is 14.1 kWh/d (5146 kWh/y); the comparable value for lights plus appliances is 17 kWH/d (6205 kWh/y). The range of domestic water use is from 9 to 18 kWh/y and the range for appliances is 14 to 22 kWh/d. Electrical energy consumption follows a monthly sinusoidal variation which peaks during the extreme winter months and is at a minimum during summer months. 3 figs., 3 tabs.

4653 **(ORNL/M—658) Building thermal envelope systems and materials (BTESM) and research utilization/technology transfer progress report for DOE Office of buildings and community systems: Monthly progress report.** Samples, S.D. (comp.); Coleman, G.L. (comp.). (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 57p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89003719/JAW.

The Monthly Report of the Building Thermal Envelope Systems and Materials (BTESM) Program is a monthly update of both in-house ORNL projects and subcontract activities in the research areas of building materials, wall systems, foundations, roofs, building diagnostics, and research utilization and technology transfer. Presentations are not stand-alone paragraphs every month. Their principal values are the short-time lapse between accomplishment and reporting and their evaluation over a period of several months.

4654 **(PNL—6740) Focus group discussions of daylighting practices.** Roberson, B.F.; Harkreader, S.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 35p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004148/JAW.

This research was sponsored by the US Department of Energy (DOE) Office of Buildings and Community systems and conducted by Pacific Northwest Laboratory (PNL) as part of an ongoing effort to enhance the commercial use of federally developed technologies. One such technology is the use of daylighting practices in the design of nonresidential buildings. This document is a report of the findings from meetings of focus groups conducted to gain insight into building designers' perceptions and attitudes about daylighting systems.

4655 **(SERI/STR—254-3175) PSTAR: Primary and secondary terms analysis and renormalization: A unified approach to building energy simulations and short-term monitoring.** Subbarao, K. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 93p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89000816/JAW.

This report presents a unified method of hourly simulation of a building and analysis of performance data. The method is called Primary and Secondary Terms Analysis and Renormalization (PSTAR). In the PSTAR method, renormalized parameters are introduced for the primary terms such that the renormalized energy balance equation is best satisfied in the least squares sense, hence, the name PSTAR. PSTAR allows extraction of building characteristics from short-term tests on a small number of data channels. These can be used for long-term performance prediction ("ratings"), diagnostics, and control of heating, ventilating, and air conditioning systems (HVAC), comparison of design versus actual performance, etc. By combining realistic building models, simple test procedures, and analysis involving linear equations, PSTAR provides a powerful tool for analyzing building energy as well as testing and monitoring. It forms the basis for the Short-Term Energy Monitoring (STEM) project at SERI.

4656 **(SERI/TR—254-3347) PSTAR: Primary and secondary terms analysis and renormalization: A unified approach to building energy simulations and short-term monitoring: A summary.** Subbarao, K. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 21p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000814/JAW.

This report summarizes a longer report entitled PSTAR - Primary and Secondary Terms Analysis and Renormalization. A Unified Approach to Building Energy Simulations and Short-Term Monitoring. These reports highlight short-term testing for predicting long-term performance of residential buildings. In the PSTAR method, renormalized parameters are introduced for the primary terms such that the renormalized energy balance equation is best satisfied in the least squares sense; hence, the name PSTAR. Testing and monitoring the energy performance of buildings has several important applications, among them: extrapolation to long-term performance, refinement of design tools through feedback from comparing design versus actual parameters, building-as-a-calorimeter for heating, ventilating, and air conditioning (HVAC) diagnostics, and predictive load control. By combining realistic building models, simple test procedures, and analysis involving linear equations, PSTAR provides a powerful tool for analyzing building energy as well as testing and monitoring. It forms the basis for the Short-Term Energy Monitoring (STEM) project at SERI. 3 figs., 1 tab.

4657 **(SERI/TR—254-3356) Short-Term Energy Monitoring (STEM): Application of the PSTAR method to a residence in Fredericksburg, Virginia.** Subbarao, K.; Burch, J.D.; Hancock, C.E.; Lekov, A.; Balcomb, J.D. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1988. Contract AC02-83CH10093. 43p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000815/JAW.

This report describes a project to assess the thermal quality of a residential building based on short-term tests during which a small number of data channels are measured. The project is called Short- Term Energy Monitoring (STEM). Analysis of the data provides extrapolation to long-term performance. The test protocol and analysis are based on a unified method for building simulations and short-term testing called Primary and Secondary Terms Analysis and Renormalization (PSTAR). In the PSTAR method, renormalized parameters are introduced for the primary terms such that the renormalized energy balance is best satisfied in the least squares sense; hence, the name PSTAR. The mathematical formulation of PSTAR is detailed in earlier reports. This report describes the short-term tests and data analysis performed using the PSTAR method on a residential building in Fredricksburg, Virginia. The results demonstrate the ability of the PSTAR method to provide a realistically complex thermal model of a building, and determine from short-term tests the statics as well as the dynamics of a building, including solar dynamics. 10 refs., 12 figs., 2 tabs.

4658 **(SMA—1988) Energy conservation through water treatment.** Silbert, M.D. (Silbert (Marvin) and Associates, Willowdale, Ontario (Canada); Ontario Ministry of Health, Toronto (Canada); Ontario Ministry of Energy, Toronto (Canada)). [1988]. 98p. (MICROLOG—88-04885). Ontario Government Publications, Publications Services, 880 Bay Street, 5th. Floor, Toronto, Ont., Canada M7A 1N8; $7.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Water is commonly used to transfer heat within hospital heating, ventilating, and air conditioning (HVAC) systems. Dissolved minerals and microorganisms in the water can lead to the growth of deposits that reduce heat transfer, resulting in increased operating and maintenance costs. There are a number of improvements to the water treatment programs and equipment now in place that can lead to conservation of much of the energy otherwise wasted due to fouled or scaled heat transfer surfaces, and at the same time reduce maintenance and chemical product consumption. This report describes these improvements and how they can be implemented. Basic principles of scaling, fouling and corrosion in HVAC systems are examined. Methods are described for minimizing corrosion and for pretreatment of water to deal with suspended and dissolved solids and microbiological contamination. Improving energy efficiency in HVAC and boiler systems can then be achieved by applying water treatment and by using such energy conservation practices as recovering boiler condensates. Perhaps the single most cost-effective conservation measure is proper control, with monitoring and data analysis data having an important role. Recommendations are made for specific hospital applications. A significant capital cost savings is achievable by integrating boiler plant needs with those of other users; in a typical hospital, the quantity of water needed by other applications may exceed that needed by the boiler, and the same plant can supply both at little additional cost. By integrating both needs, only one water treatment facility is required. 20 figs., 9 tabs.

3202 Transportation

REFER ALSO TO CITATION(S) 4765

4659 **(PB—88-239884/XAB) Urban Transportation Abstracts. Volume 6, No. 1 - Summer 1987. Report for April-November 1987.** (Urban Mass Transportation Administration, Washington, DC (USA)). Jun 1988. 240p. (UMTA-DC—06-0559-87-1). NTIS, PC A11/MF A01.

Also pub. as Urban Mass Transportation Research Information Service, Washington, DC. rept. no. UMTA-TRIC-87-01. See also PB—82-203308. Library of Congress catalog card no. 83-640066.

Urban Transportation Abstracts is a semiannual publication that features abstracts and research project summaries on planning, designing, financing, constructing, operating, maintaining, managing, and marketing all modes of public transit. Some of these modes are advanced-guideway systems, buses, carpools, commuter services, elderly and handicapped transport, heavy-rail transit, light-rail transit, paratransit, rapid transit, streetcars, taxicabs, trolley buses, and vanpools. Each issue is divided into five sections: (a) abstracts of reports and journal articles, (b) summaries of ongoing research, (c) a source index, (d) an author index, and (e) a subject index.

4660 **(UCID—21388) MaRV Penetration Study Project: MaRV discrimination studies: Final report for FY87.** Morris, J.M. (Lawrence Livermore National Lab., CA (USA)). Apr 1988. Contract W-7405-ENG-48. 68p. NTIS, PC A04/MF A01. Order Number DE89003717/JAW.

This report describes the MaRV discrimination studies results obtained during FY87 in support of the MaRV Penetration Study Project. Several single-sensor discrimination algorithms and a multi-sensor "Data Fusion" technique are proposed for inclusion in the MaRV penetration study simulator under development. The goal of this fiscal year's investigation was to provide algorithms that are immediately useable with the simulator, and that support the testing of the simulator and its subsystems. The algorithms presented, consequently, are of relatively low complexity and have explicit predicted performance expressions. The model assumptions required to achieve these results, and future efforts proposed to refine the models and resulting algorithms, are briefly discussed. 9 refs., 13 figs.

4661 **(WU/IUS—81) The consumer and transportation: an investigation of consumer perceptions towards transportation.** Fenton, R.; Hull, J. (Manitoba Univ., Winnipeg (Canada). Inst. of Urban Studies). 1981. 172p. (CE—01984). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A survey of employees of four Winnipeg firms was conducted on transportation modes and frequency of use, reasons for use of current modes, information on availability and cost of alternate modes, preferences for ideal transport modes, and socio-economic characteristics of respondents. The firms were located both in the city, where public transport was available, and in the suburbs, where public transport was of limited access. It was concluded that a potential exists for the marketing of shared transportation modes for the journey to work. These modes should be non-capital intensive and responsive to specialized demands. The alternative mode would be geared to the needs of particular groups of employees from among employers located at a specific, well-defined work location. The need for responsiveness to a range of demands and needs suggests that the service be designed around relatively small-capacity vehicles. Alternative routings and potential for flexibility of departure times would add to the attractiveness of the service. The study also concludes that the development and marketing of this service must be done in conjunction with extensive trials and demonstrations of this service and technology. Attitudes and perceptions towards potential modes are correlated with current modes of travel to work. The correlation is highest between the auto driver and mode characteristics reflecting door-to-door transport and immediate availability of the vehicle. 29 refs., 39 figs., 17 tabs.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 4117, 4291, 4405, 4647, 4874, 4937

4662 **(AC/R—83) The Energy, Research and Development in Agriculture and Food Program (ERDAF).** LeBlanc, D. (Agriculture Canada, Ottawa, Ontario. Research Branch). [1983]. 6p. (CE—02002). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The objectives of the food processing, distribution and retailing programs in Canada's Energy, Research and Development in Agriculture and Food Program are described with a view to soliciting research proposals. Research and development priorities are: examining alternatives to thermal processing, or improving the energy efficiency of presently used thermal processes; upgrading or replacing conventional water removal operations; reduction of energy consumption in refrigeration, and investigating alternatives such as modified atmospheric storage; and, evaluating and demonstrating new packaging systems that conserve energy due to the nature of the package material itself, the package type, or the processing and handling methods. Other areas of special interest include optimization of energy intensive processes in retailing, distribution, consumption, and partial processing on the farm.

4663 **(CESI—86-27) Energy characterization of low voltage asynchronous motors.** Buccianti, R. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Oct 1986. 3p. (In Italian). (CONF-8610441—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770039/JAW.

From Annual meeting of CNR group on electrical and electronic measurements; Selva di Fasano, Italy (1 Oct 1986).

In order to characterize the energy performance of low-voltage asynchronous motors, the design of a device based on the calorimetric method was considered. Such a method permits the direct determination of losses.

4664 **(CESI—87-13) The main Italian experimental facilities for the testing and qualification of apparatuses and components for industrial applications.** Di Bartolomeo, M.; Catenacci, G. (Centro Elecctrotecnico Sperimentale Italiano, Milan). May 1987. 56p. (CONF-8705344—1). NTIS (US Sales Only), PC A06. Order Number DE89770035/JAW.

From Italian industrial capabilities in the sphere of construction and operation of electric power generating plants; Beijing, China (21 May 1987).

The reliability of apparatuses and components for industrial applications has an essential impact both on the safety and economy of energy systems operations. In the processes of fabrication and demonstration of reliability, in turn, a central role is played by adequate development and qualification tests. To provide these vital services, a number of experimental centers have been established in Italy, equipped with the necessary capabilities and facilities. These resources are made available to the Italian industry and institutions as well as to foreign organizations and companies, also within the framework of international agreements. The paper presents the major experimental centers existing in Italy, namely: the centers of ENEA-CASACCIA, SIET, ANSALDO-BOSCHETTO, FIAT-CIEI, CESI, CISE and ISMES and reviews the experience, the test facilities and most significant activities in progress.

4665 **(DOE/CE—0235) The DOE Industrial Energy Conservation Program: Research and development in waste products utilization technology.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). Jul 1988. 31p. NTIS, PC A03/MF A01. Order Number DE89002981/JAW.

This brochure summarizes the research and development efforts undertaken by the Office of Industrial Programs in the area of waste products utilization. The sections which follow are representative of a larger portfolio of projects and provide information on federal industrial energy conservation activities in waste utilization. These sections are: Industrial wastes - a summary of the current status of industrial waste management and of the potential savings associated with industrial wastes; Waste products utilization R & D - a description of waste products utilization R & D projects funded by the Office of Industrial Programs; and R & D data base - a list of contractors, principal investigators and locations for each IP-sponsored project relating to waste products utilization. 15 figs.

4666 **(DOE/CE—0239) Energy conservation standards for consumer products: Refrigerators, furnaces, and television sets including Environmental Assessment (DOE/EA-0372) Regulatory Impact Analysis: Technical support document.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Building Equipment Div.). Nov 1988. 524p. NTIS, PC A22/MF A01. Order Number TI89002738/JAW.

The Energy Policy and Conservation Act (P.L. 94-163), as amended by the National Appliance Energy Conservation Act of 1987 (P.L. 100-12) and by the National Appliance Energy, provides energy conservation standards for 14 types of consumer products and authorizes the Secretary of Energy to prescribe amended or new energy standards for each type (or class) of covered product. The assessment of the proposed standards on the three types of products presented in this document is designed to evaluate their economic impacts according to these criteria. It includes an engineering analysis of the cost and performance of design options to improve the efficiency of the products; forecasts of the number and

average efficiency of products sold, the amount of energy the products will consume, and their price and operating costs with and without the standards; a determination of change in investment, revenues and expenditures by manufacturers of the products; a calculation of the costs and benefits to consumers, electric utilities and the nation as a whole; and an assessment of the environmental impacts of the proposed standards. 75 refs., 61 figs., 205 tabs.

4667 **(DOE/CE/40626—T4) Research on droplet formation for application to kraft black liquors: Final report: Tasks I and III, report No. 4.** Stockel, I.H. (Maine Univ., Orono (USA)). Oct 1988. Contract AC02-83CE40626. 204p. NTIS, PC A10/MF A01 - OSTI. Order Number DE89001755/JAW.

The overall objective of this project is to generate technical data with which to design nozzles for kraft black liquor recovery boilers which can reduce under and over size droplets and adjust for changing black liquor properties and production requirements. The research is organized into five tasks: Droplet formation from a single jet, theoretical and experimental--ambient gas medium; Surface tensions of black liquor; Aerodynamic/hydrodynamic stability/instability of droplets once formed; Black liquor droplet formation from a single jet--furnace gas medium; Prototype of a new nozzle design. 88 figs.

4668 **(DOE/ID—10210) Membrane applications and research in food processing: An assessment.** Mohr, C.M.; Leeper, S.A.; Engelau, D.E.; Charboneau, B.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1988. Contract AC07-76ID01570. 317p. NTIS, PC A14/MF A01. Order Number DE88016250/JAW.

This assessment is intended to aid in planning separations research and development projects aimed at reducing energy consumption in the food industry. The food processing industry uses approximately 1.5 quadrillion Btu per year, 2% of the US national annual energy consumption. Food processing involves a variety of liquid feed, product, and waste streams and makes extensive use of thermal operations such as drying, evaporation, pasteurization, and distillation. As such, it is a candidate for energy conservation through the use of membrane separations. The assessment is organized according to Standard Industry Classification (SIC) Code for the food industry. Individual subindustries considered are: (a) Meat Processing, Dairy Products, Preserved Fruit and Vegetables, Grain Milling, Bakery Products, Sugar and Confectionery products, Edible Fats and Oils, and Beverages. Topics covered include: (a) background information on food processing and membrane separations, (b) a review of current and developing membrane separations for the food industry, (c) energy consumption and processes used in individual subindustries, (d) separations in the subindustries that could be augmented or replaced by membrane processes, (e) industry practices and market conditions that could affect adoption of new technologies, and (f) prioritized recommendations for DOE-OIP supported research to further use of membrane separations in the food industry. 435 refs.

4669 **(DOE/ID/12608—2-Vol.2) Design and control of energy efficient drying processes with specific reference to foods: Volume 2, Food property studies and recommendations: Final report, September 23, 1985--April 23, 1987.** Franzen, K.; Liang, H.; Litchfield, B.; Murakami, E.; Nichols, C.; Waananen, K.; Miles, G.; Okos, M. (Purdue Univ., Lafayette, IN (USA)). Apr 1987. Contract FG07-85ID12608. 209p. NTIS, PC A10/MF A01; 1; GPO Dep. Order Number DE88008734/JAW.

Research on the drying of food, with particular emphasis on energy conservation, is presented. Topics discussed include: pasta drying, viscoelastic properties, food quality, thermal conductivity, microwave moisture measurements, and prediction of breakage in corn. (CBS)

4670 **(ENEA-RT-FARE—87-12) Innovation and rational use of energy: general problems and specific aspects in the brick production sector.** Tomassetti, M. (ENEA, Rome (Italy)). Mar 1988. 11p. (In Italian). (CONF-8610440—1). NTIS (US Sales Only), PC A03. Order Number DE88755365/JAW.

From ANDIL-ENEA meeting; Rimini, Italy (3 Oct 1986).

Innovation in the traditional sectors is a very complex phenomena: technological, scientific, social and managerial aspects are involved. The report considers the evaluation of traditional Italian research and the opportunity for synergy between innovation and energy saving. The specific situation of the brick production sector is analized and prospectives given for more efficient production and factory innovation.

4671 **(FO/FDB—1985) Communication strategy for technology transfer. Final report.** (Department of Fisheries and Oceans, Halifax, Nova Scotia (Canada). Fisheries Development Branch). [1985]. 200p. (CE—01957). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

A series of technology transfer workshops for the fishing industry was held in Atlantic Canada. The purpose of these workshops was to disseminate existing technical information on how to improve productivity, efficiency, and product quality; to investigate the effectiveness of the information provided and the suitability of the workshop format for information transfer; and to facilitate information and personnel exchange among Canadian fisheries officials. Twelve workshops were conducted on three subject areas: onboard handling and holding, mobile gear, and fixed gear. The workshops, which also included an energy package, were specifically directed to fishermen. Questionnaires were used to evaluate the workshops and the information presented. It was concluded that the workshops were a success, both as a medium for transferring technical information to fishermen and as a means of receiving feedback on work being done by the Fisheries Development Branch. Video presentations received the most favorable response. It was felt that improvements need to be made in distribution of visual materials, such as a library type of system for video tapes. Because of a lack of printed materials from some of the fisheries research projects, it was also felt that presentations to workshops should be made part of any project development plan, in order to maximize the impact of the workshop approach.

4672 **(QMA—AGDEX763) Tractors - fuel consumption.** (Quebec Ministere de l'Agriculture, des Pecheries et de l'Aminentation, Ste-Foy (Canada)). Sep 1987. 6p. (In French). (MICROLOG—88-04620). Quebec Ministere de l'agriculture, des pecheries et de l'alimentation, 200A, chemin Ste-Foy, Quebec, P.Q., Canada G1R 4X6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document can be used for estimating the use of fuel in agriculture and is subdivided into three parts: average fuel consumption of tractors at different power levels; fuel consumption according to type of operation, per unit of surface area; and fuel consumption according to type of operation and soil preparation. Types of farm operations covered in this document include soil preparation, planting, soil treatment, haying, silage processing, harvesting, threshing, and transport (on-farm and on-road). 3 tabs.

4673 **(SRC—TR208) Farm Enerdemo Project. Task 1. Background report.** Rutherford, A.; Gimby, M. (Saskatchewan Research Council, Saskatoon (Canada)). Feb 1988. 40p. (MICROLOG—88-04338). Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Farm Enerdemo Project was instituted in Saskatchewan in order to develop a better understanding of farm fuel use. Project efforts were coordinated around three objectives: the evaluation of on-farm fuel monitoring as a cost control technique; the determination of fuel requirements of common field operations and their combination in definable cropping systems; and the establishment of fuel cost importance, relative to other energy costs of cropping practices. Volunteer farms provided daily fuel measurements and crop production information for a variety of energy comparisons. This report presents a general outline of procedures used in this project and the results of the investigation. It was found that rou-

tine application of fuel monitoring on farms identified practical fuel saving actions. Monitoring results have established reference fuel consumption rates for common farm operations. Observations indicate aggregate field consumption in the range of 10-14 l/acre for summer-fallow crops and 8-11 l/acre for stubble crops. Variation within a rotation position arises from tillage practice and, to a lesser extent, soil zone location. Improved efficiency of fuel use occurs when stubble crop yields are in excess of 2/3 of summerfallow production. Minimum or zero-till practices reduce the fuel requirement for the production of a given crop independent of cropping rotation, but the fuel saving is only marginal for the tradeoff cost of herbicide substitutes for tillage weed control. In this respect, a minimum tillage approach appears the most favorable. Farm area transportation support of cropping activities consumes about 4 liters per seeded acre. 12 refs., 12 figs., 19 tabs.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 4580, 4606

4674 **(BCMEP—1988) Report of the 1986 municipal solid waste management survey.** Stone, M. (British Columbia Ministry of Environment and Parks, Victoria (Canada)). Jan 1988. 128p. (MICROLOG—88-04597). British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, B.C., Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this report is to present the results of a survey undertaken in British Columbia to determine the current quantities of solid wastes collected, recycled and disposed of by incorporated municipalities and regional districts during 1986. In addition, the costs and labor requirements associated with solid waste management were collected as was information on the source and composition of the solid wastes. Data are presented on who collected solid waste, how much was collected, how frequently it is collected, where it is collected from, and the types of equipment used for collection. The recycling programs offered by some local governments are discussed; information is compiled on the number of recycling programs, the type of program, the number of depots used, the number of households served by curbside pickup, and the quantity and price of materials collected for recycling. A discussion of how local governments dispose of their solid wastes includes information on the total weight of solids disposed, the number and type of disposal sites, the source of the waste, tipping fees, and labor requirements. A final chapter reviews the costs of solid waste management in British Columbia during 1986, including the costs of collection, recycling and disposal. A comparison of solid waste management to other Canadian provinces is also given. 7 refs., 61 tabs.

4675 **(CONF-8612165—) Waste and waste water problems at power plants and waste incineration plants. Lectures.** (Landesamt fuer Wasser und Abfall Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1987. 241p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89770096/JAW.

From Advanced training course of the Landesamt fuer Wasser und Abfall Nordrhein-Westfalen; Essen, F.R. Germany (3 Dec 1986).

Ten papers given at this meeting inform - particularly with respect to North-Rhine Westphalia (FRG) - on present state and development of laws and regulations on air pollution abatement and waste management, power plants and their flue gas purification, waste gas and waste water treatment in waste combustion plants, as well as on yields and utilization of solid residues of power plants and waste incineration plants.

4676 **(CONF-8704331—) Feasible variants of materials recycling.** (Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Wasserwesen). 1987. 139p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE89770007/JAW.

From Water management colloquium: feasible variants of materials recycling; Muenchen, F.R. Germany (30 Apr 1987).

The brochure contains the papers read at the colloquium, dealing with waste management concepts (both material and thermal), a comparative assessment of different systems, economic and ecological consequences and social obstacles to innovations.

4677 **(DOE/CE/26556—T1) Camden, New Jersey district heating and cooling feasibility assessment.** (Resource Development Associates, Inc., Dayton, OH (USA)). Dec 1987. Contract FG01-86CE26556. 81p. NTIS, PC A05. Order Number DE89003429/JAW.

This report is a feasibility study on district heating and cooling in the Camden, New Jersey area. The following information is contained in this report: the focus of the project; thermal source options; demand; annual energy consumption; retrofitting considerations; and system economics. 21 figs. (FL)

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 4584, 4661

4678 (CONF-8606416—, pp 60-70) **Universities as technology transfer vehicles in the developing countries - example: Renewable energy sources.** Heinen, K.U. 1986. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE89770006/JAW.

From Meeting on solar process heat; Aachen, F.R. Germany (19 Jun 1986).

The education and advanced training of solar engineers coming from industrial and developing countries exemplifies the universities' capacity of promoting technology transfers. Comprehensive university programs provide for scholarships to train university teachers from the developing countries, as well as for permanent university teachers and experts in the fields of science, research, and technical counselling. Programs are also provided for know-how transfers through universities of the industrial countries, the establishment of educational facilities, and university programs in the developing countries. The Cologne technical university exemplifies and explains the technology transfer programs. Additional three-term courses on 'technology in the tropics' include project management, building construction in the tropics, industrial machinery and production engineering, agricultural machinery and production engineering. Educational emphasis is on renewable energy source uses. (HWJ).

4679 **(EMR—81) A pre-evaluation assessment of the Energuide Program.** Kotowitz, Y. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). 1981. 58p. (CE—01986). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The purpose of the Energuide Program is to promote conservation of energy used in major domestic appliances in Canada through dissemination of information on energy efficiency. There are several major assumptions on which this program is based, such as: consumers do not make correct energy efficiency decisions in appliance purchases due to lack of information; and, competitive pressures from from knowledgeable consumers will result in manufacturers improving their appliances' energy efficiency. The purpose of this report is to evaluate the validity of these assumptions on the basis of available information. To the extent that present information is inefficient, the report points out what additional information is necessary and possible ways of obtaining it; in particular, it investigates other possible reasons for the alleged inefficiency and its possible interaction with informational deficiencies. The optimal way to proceed with the Energuide Program is also examined. It is concluded that consumers appear to apply extremely high discount rates in calculating tradeoffs between operating cost savings and capital costs, possibly because of lack of energy efficiency information, ignorance on how to perform the correct calculations, and lack of concern about energy costs. There is no direct information on the effect of Energuide on consumer appliance purchases, and only anecdotal information on introduction of energy efficient models by manufacturers. It is felt that there is not enough information to perform a cost benefit analysis for Energuide or for an alter-

native such as a mandatory standards program. A number of additional studies to resolve information gaps are proposed. 11 refs.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 4563

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 4592, 4593, 4594, 4684, 4687

4680 **(DOE/AL/38221—T5) Experimental validation of a zero-dimensional computer model for spark-ignition engines: Final report.** Scott, R.L. Jr. (Southern Univ., Baton Rouge, LA (USA). Dept. of Mechanical Engineering). 15 Nov 1988. Contract AS04-86AL38221. 80p. NTIS, PC A05/MF A01. Order Number DE89002848/JAW.

The objective of this work is to validate a computer code that simulates a spark ignited internal combustion engine. The code and a CFR engine are run for a set of similar conditions and the maximum combustion chamber pressures are compared in value and angular locations. The results indicate that the code generally predicts the engine performance. However, improvements are needed in the combustion submodel. Also, intake and exhaust submodels need to be added to the code. 15 refs., 16 figs., 12 tabs.

4681 **(NP—9770017) Noise optimization in two-stroke engines in consideration of exhaust emission and fuel consumption.** Vonderau, J.; Jaeger, R. (SACHS Systemtechnik G.m.b.H., Schweinfurt (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Jul 1985. 176p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770017/JAW.

The project focuses on high-speed, two-stroke spark ignition engines with crankcase scavenging. Engines of this type are commonly used as driving aggegates for two-wheel vehicles and small machines. A modified gas charge and refill system reduces the pressure gradients, causing marked improvements in the two-stroke noise pattern. Further noise reduction was achieved by optimizing the ignition point. The exhaust characteristics of the engines are still problematic.

4682 **(PB—88-240098/XAB) Heavy-duty diesel vehicle inspection and maintenance study. Volume 1. Summary report; Volume 2. Quantifying the problem; Volume 3. Development and validation of I/M (inspection and maintenance) test procedures; Volume 4. I/M program design and cost-effectiveness analysis. Final report, June 1985-May 1988.** Weaver, C.S.; Klausmeier, R.F. (Radian Corp., Sacramento, CA (USA)). May 1988. 617p. (DNC—87-245-019-04). NTIS, PC A99/MF A01.

Heavy-duty vehicles are major contributors to ambient levels of particulate matter and oxides of nitrogen in urban air. Implementation of an Inspection and Maintenance (I/M) program for heavy-duty diesel vehicles has been impeded by the technical difficulty of developing a suitable emissions test, and by uncertainty as to the magnitude of the problem and of the cost-effectiveness of an I/M program. The objectives of the study were: to quantify the problem of excess emissions from heavy-duty diesel vehicles; to develop preliminary I/M procedures for these vehicles; and to estimate the costs and cost-effectiveness of implementing an I/M program for heavy-duty diesels. To quantify the problem of excess emissions, a computer model of total and excess emissions from heavy-duty diesel vehicles was developed. The purpose of these procedures is to identify heavy-duty diesel vehicles that are producing excessive pollutant emissions.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 4551

3304 Hybrid Systems

4683 **(DE—10SX31155-1-4501) The development of a hybrid car. Final report. Vol. 1.** (Davis Engineering Ltd., Ottawa, Ontario (Canada)). Nov 1981. 93p. (CE—01980). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes the work done in the development of a prototype vehicle with a hydrostatic drive unit and regenerative braking. In such a system a relatively small prime mover supplies the total energy demands while peak power demands are satisfied by stored energy. The prime mover can be operated at near optimum conditions of brake specific fuel consumption, independently of the vehicle road load demands, with the energy storage receiving or supplying the excess. Such an arrangement is, in unsteady driving conditions, potentially more economical in fuel consumption. The result is that the engine can be sized smaller, loaded optimally, and allowed to respond more slowly with a particular recovery of the braking energy normally dissipated. The theory of operation is discussed and a drawing package detailing all of the hardware components is included. In addition, a working hybrid computer model of the entire hydrostatic drive system and simulation are presented. The analog simulation used in the model proved to be an essential tool for evaluation of the circuit design concept and for stability studies under various accelerator and brake inputs. These tasks would have been virtually impossible to perform on a simulation model, which did not allow for direct influence by the designer. Although some stability problems are evident in the vehicle, this study has proven the feasibility of the concept. With system refinements and minor schedule adjustments, the hydraulic hybrid drive may prove to be a viable concept for the small urban vehicle. 40 figs., 4 tabs.

3307 Emission Control

REFER ALSO TO CITATION(S) 4681, 4682, 5154, 5155

3308 Alternative Fuels

4684 **(ANL/EES-TM—352) Emission-reduction effects of methanol vehicles: State of knowledge.** Singh, M.K.; Sekar, R.R. (Argonne National Lab., IL (USA). Energy and Environmental Systems Div.). Jul 1988. Contract W-31109-ENG-38. 49p. NTIS, PC A03/MF A01. Order Number DE89001148/JAW.

Methanol-fueled vehicles are currently the subject of considerable interest as various national and local options are being considered to address the country's air quality problems. This report evaluates the emissions from several types of methanol-fueled vehicles and qualitatively assesses the potential effects of methanol fuel use on ambient air quality. The evaluation is based on the results of more than 50 recent tests of methanol-fueled vehicles and the US Environmental Protection Agency's (EPA's) most recent assessment of the emissions effects of these vehicles. The emissions from methanol use in three forms in spark-ignition engines and six potential applications in compression-ignition engines are reviewed. The greatest benefit from neat-methanol-fueled or flexible-fuel vehicles is the lower reactivity of their volatile organic compound emissions relative to gasoline-fueled vehicles, thus potentially reducing the contribution of mobile pollution sources to the formation of ozone. The primary advantage of methanol blends is the reduction in carbon monoxide emissions relative to gasoline-fueled vehicles. Finally, nitrogen oxide and particulate emissions are substantially reduced in the various neat methanol applications to heavy-duty diesel engines. Methanol may thus provide a means of meeting the EPA's stringent 1991-1994 particulate regulations for heavy-duty diesel engines and vehicles. 70 refs., 15 tabs.

4685 **(BI/RDPD—ERD/08/85) DND/Bombardier alternate fuels test programme, phase 2. Final report.** Chan, D.Y. (Bombardier, Inc., Montreal, Quebec (Canada). Rail and Diesel Product Div.). Mar 1985. 173p. (CE—01968). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Tests have been carried out on a series of test fuels representative of future Canadian medium speed diesel fuel possibilities. A 12-cylinder, V configuration, 4-stroke direct injection marine/rail diesel engine was fitted to optimize performance with low quality fuels. The central objective of this study was to determine the operability, performance, combustion and wear characteristics of the fuel and to compare the results with engine performance from an earlier study using a reference fuel. Mixing of heavy residual and diesel fuels was accomplished by a microprocessor-based automatic fuel blending system developed specifically for these tests. A series of low temperature idling tests were run during winter 1984 to measure deposit accumulation. Results indicated that 72 hours of idling at conditions simulating typical Canadian winter conditions posed no engine operational problems using the 1990 blend fuel; with the heavy fuel blend, fuels had to be preheated externally to obtain satisfactory fuel filtering, and deposit accumulation was much higher. A series of 500-hour endurance tests were undertaken to identify operational difficulties, engine deposits, or component wear. With the 1990 fuel, results were similar to operation on no.2 diesel fuel; with the heavy fuel, a number of exhaust valves failed at test cycle 210, mainly due to high temperature corrosion. Deposit accumulation was that expected for a heavy fuel. The work indicated that a typical North American medium speed diesel engine is capable of running at least 420 hours under a severe duty cycle with a test fuel containing 30% heavy residuals. 19 refs., 85 figs., 2 tabs.

4686 **(CONF-881138—1) Results from the Federal Methanol Fleet: A progress report.** McGill, R.N.; Graves, R.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number TI88015291/JAW.

From 8. international symposium on alcohol fuels; Tokyo, Japan (13 Nov 1988).

The Federal Methanol Fleet, initiated by the United States Congress in fiscal year 1985 and managed by the Oak Ridge National Laboratory (ORNL) for the Department of Energy (DOE), is a project to evaluate a variety of methanol vehicles with different engine/fuel systems and to gather information regarding their operation in typical fleet environments. Three different DOE laboratories serve as fleet sites for the project. Twenty vehicles of four different types have been retro-fitted for methanol and are being evaluated alongside nineteen comparable gasoline vehicles. Engine types in the project include four-cylinder engines, V-6s, V-8s; fuel system include carburetors, throttle-body fuel injection, and port fuel injection. Some of the methanol engines have increased compression ratios, while others utilize turbo-chargers. Results highlighted in this paper include emissions, lubricating oil analyses, and cold-weather performance. 6 refs., 2 figs., 5 tabs.

4687 **(FRT—81-D-0592) Power Diesel engine using directly solid fuels. Thermodynamics and technological feasibility.** Dumont, J.N.; Galant, S. (Societe Bertin et Compagnie, 78 - Plaisir (France)). Mar 1983. 25p. (In French). NTIS (US Sales Only), PC A03. Order Number DE88755448/JAW.

A mathematical model is developed and checked by tests allowing energy calculation for usual coals. Particles of diameter between 20 and 80 micrometers can be burnt with high efficiency. Taking into account fuel injection and air admission characteristics of present-time engines, for slow engines (400 rpm) optimimum size of particle is about 80 micrometers and effective efficiency 0.39, for fast engines (1600 rpm) particle size required is 20 micrometer and effective efficiency about 0.40 depending mainly upon air excess. Efficiency is about 5 points below efficiency of liquid fuels. Technological problems of injection, abrasion and friction are examined. 5 figs, 10 refs.

4688 **(NRC/ME—NRCC28536) Alternative transportation fuels: review of research activity in Canada.** Gardner, L.; Hallett, P.; Hill, P.; James, B.; Odgers, J. (National Research Council of Canada, Ottawa, Ontario. Div. of Mechanical Engineering). [1988]. 154p. (MICROLOG—88-04431). National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, Ont., Canada K1A 0R6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A review has been made of recent research and development activities in alternative fuels for transportation in Canada. The review covers progress in fundamental research on combustion of alternative fuels for gas turbines and for reciprocating engines, relating to such phenomena as ignition quality, knock, flame speed, heat transfer, and emissions. The kinds of fuel considered include natural gas, hydrogen, hydrocarbon fuels derived from oil sands and heavy oil, and alcohols. It is seen that a great deal of time and effort is required to develop satisfactory substitutes for petroleum-based fuels, and it cannot be said that there is now an adequate inventory of substitute fuel technology which can be rapidly applied on a large scale, should the need arise. For certain applications, such as aircraft, liquid petroleum-derived fuels are uniquely valuable, and the problem of fuel substitution in Canada is mainly related to the applicability of oil-sand-derived fuels. The properties of these fuels can have important effects on ignition, extinction, emissions, and engine durability. For land and sea transport a variety of fuel alternatives are available, but all have substantial problems. Possible substitutes for diesel fuel include methanol, natural gas and propane, and oil sand derivatives. However, the gaseous fuels have problems including storage and safety; methanol fuel problems include corrosivity and lubricity; oil sand derivatives have problems with ignition and emissions. Recommendations are made for future research. 50 refs., 13 tabs.

4689 **(OTC—8503) Switching to propane. A guide to successful conversion.** (Ontario Ministry of Transportation and Communications, Ottawa (Canada); Ontario Ministry of Health, Toronto (Canada)). Mar 1985. Vp. (CE—02044). Ontario Ministry of Transportation and Communications. Transportation Technology and Energy Branch, 1201 Wilson Ave., Downsview, Ont., Canada M3M 1J8; $N/C.

This booklet has been prepared as a guide to those who have decided to convert vehicles from gasoline to propane and would like more information on all of the requirements for a good propane conversion. Some reasons for conversion to propane are: high performance, ability to perform well in an internal combustion engine designed for gasoline, possible reduction in maintenance cost, and lower price. The economics of conversion in Ontario are discussed. The points to be considered in choosing a propane carburetion supplier are outlined. The characteristics of a good propane conversion, and the components of a propane carburetion system are described. The major components are: a pressurized, heavy gauge fuel tank; a filter/fuelock, which removes foreign matter from the liquid fuel and which automatically shuts off the propane flow when necessary; a converter/regulator for reducing the pressure of the fuel; and a carburetor, which meters and mixes fuel and air for proper combustion. Ontario regulations and applicable standards are introduced where appropriate. Routine operation of propane vehicles is much like operating a gasoline powered vehicle, but attention needs to be paid to two areas: engine lugging on manual transmission vehicles, and engine warmup. Routine maintenance is also discussed. Common types of propane fuel dispensers and service station equipment are explained. The booklet concludes by giving regluations and standards applicable to propane carburation, and specifications for light vehicle propane conversion. 44 figs., 1 tab.

4690 **(OTC—8607) Switching to natural gas. A guide to succesful conversion.** (Ontario Ministry of Transportation and Communications, Ottawa (Canada); Ontario Ministry of Health, Toronto (Canada)). Jul 1986. Vp. (CE—02046). Ontario Ministry of Transportation and Communications. Transportation Technology and Energy Branch, 1201 Wilson Ave., Downsview, Ont., Canada M3M 1J8; $N/C.

This booklet describes the characteristics and economics of natural gas powered vehicles and gives guidelines for use in coverting vehicles to natural gas operation in Ontario. Criteria to be used in selecting a conversion contractor are discussed. Components of a natural gas conversion are described: fuel cylinders, selection switch for dual-fuel operation, ignition system adjustments, air-gas mixer and carburetor, automatic shut-off valve, pressure regulator, supply lines, fuelling connection, master shut-off valve, and fuel gauge. Operation of a natural gas vehicle is similar to operating a gasoline powered vehicle, but there are differences that need attention, including proper warm-up, higher spark energy for ignition, and proper lubrication. Brief discussion is presented on management of fleets of converted natural gas vehicles, and regulations and standards applicable to natural gas vehicles in Canada. 24 figs.

4691 **(OTC—AF-86-09) Propane and natural gas in the Ontario transit industry.** Topaloglu, T. (Ontario Ministry of Transportation and Communications, Ottawa (Canada); Ontario Ministry of Health, Toronto (Canada)). Nov 1986. 25p. (CE—02047). Ontario Ministry of Transportation and Communications. Transportation Technology and Energy Branch, 1201 Wilson Ave., Downsview, Ont., Canada M3M 1J8; $N/C.

In two independent and unique demonstrations, Ottawa-Carleton Transpo and Hamilton Street Railway are assessing the viabilities of propane and natural gas as alternatives to diesel fuel in transit bus fleets. The potential advantages of these alternatives are greater availability, consistent quality, lower cost, lower exhaust emissions and lower noise levels. The demonstrations were planned to include a test phase to assess technical viability followed by an extensive revenue service evaluation and rider/driver surveys. To date, the test phase has been completed and the two transit authorities are proceeding with the in-service evaluation. The demonstrations have already produced substantial experience and know-how with the use of propane and natural gas in transit environments. In this paper, the experience gained in the engine and bus conversions, the performance and reliability of the buses and fuelling facilities, the preliminary economics of the alternative fuels, and the results of the test phase are presented. 9 figs., 7 tabs,

4692 **(OU/ME—AVGP-GM6V53T) Combustion modelling for diesel engines. Vol. 2. Thermodynamic and multidimensional modelling. Interim report.** (Ottawa Univ., Ontario (Canada). Dept. of Mechanical Engineering). May 1984. 150p. (CE—01974). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

To understand the effects of off-specification diesel fuels on the AVGP-GM6V53T engine, thermodynamic and multidimensional modelling was carried out. The thermodynamic model is based on overall conservation equations. It computes/predicts engine indicated performance by considering the dominant phenomena in specific stages throughout the cycle. The established model was extensively evaluated and culminated in a preliminary parametric study. In general, indicated and combustion parameter mapping together with diagnostic mass burning rate analyses provided the deepest insight into understanding the model behaviour. It was found that the model predicted accurate full torque performance and accurate behavioral trends over the complete engine operating range. Numerical discrepancies increased with decreasing load; this was determined to result from the combustion development. The preliminary parametric study clearly confirmed the benefits of intercooling and also showed that earlier injection timing at full rack settings would provide substantial increases in engine performance. Multidimensional modeling of the in-cylinder flow is presented during compression, expansion and scavenging. The model is based on a numerical solution of the governing differential equations. Resulting flow fields are illustrated for different engine speeds during compression and expansion and different flow rates during scavenging. The complex geometries of valve simulation and air-box connection and their effect on the flow pattern is discussed. 64 refs., 60 figs., 7 tabs.

35 ARMS CONTROL

3503 Verification

REFER ALSO TO CITATION(S) 5049

4693 **(UCRL—97236) SEA [Seismic Event Analyzer]: An expert system for nuclear test ban treaty verification.** Mason, C.L.; Searfus, R.M.; Johnson, R.R.; Lager, D. (Lawrence Livermore National Lab., CA (USA)). Aug 1987. Contract W-7405-ENG-48. 15p. (CONF-8711240—1). NTIS, PC A03/MF A01. Order Number DE89001135/JAW.

From Australian joint artificial intelligence conference; Sydney, Australia (2 Nov 1987).

This paper presents an expert system that interprets seismic data from Norway's regional seismic array, NORESS, for underground nuclear weapons test ban treaty verification. Three important aspects of the expert system are it emulates the problem solving behavior of the human seismic analyst, it acts as an assistant to the human analyst by automatically interpreting and presenting events for a review, and it enables the analyst to interactively query the systems's chain reasoning and manually perform an interpretation. The general problem of seismic interpretation is described. The expert system is presented in terms of problem solving strategy, representation structures and user interface elements. 12 refs., 8 figs.

36 MATERIALS

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 4131, 4147, 4402, 4402, 4402, 4407, 4407, 4410, 4410, 4461, 4469, 4487, 4487, 4488, 4615, 4615, 4773, 4825, 4931, 4931, 4934, 5094, 5576, 5581, 5588, 5589, 5590, 5613

4694 **(AD-A—197047/4/XAB) Test methodology for an investigation into heating and cooling phenomena in grossly deformed tensile metallic bars.** Molent, L.; Dunn, S. (Aeronautical Research Labs., Melbourne (Australia)). Dec 1987. 39p. (ARL/STRUC-TM—482). NTIS, PC A03/MF A01.

The coupling between mechanical deformation and thermal energy in an elastic material, known as the thermoelastic effect, was first documented by Gough in 1805, who observed that the material experienced a change in temperature during elongation. More recently, investigation of the phenomenon of energy exchange in metals has been extended into the plastic regime, where a material experiences heating after the elastic limit has been exceeded, i.e., the thermoplastic effect. It is proposed to measure the local temperature, strain and cross-sectional area of various specimens undergoing adiabatic elastoplastic deformation, and to deduce the local stress. These parameters are necessary if the relationship between the measured temperature and the dissipated and available energies is to be determined. Of the available devices for minute temperature measurements, namely thermistors and infrared detectors, the latter were chosen for this work.

4695 **(CEGB-TPRD/B—1052/R88) Influence of reciprocating sliding wear on the oxidation behaviour of Fe-12Cr steel.** Smith, A.F. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1988. 25p. (AGR/CIF/TWG/P—88-249; AGR/CIF/CCWG/P—88-3). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755437/JAW.

Medium-chromium ferritic alloys are used extensively in the boiler and core sections of advanced gas cooled reactors. It was discovered in the early 1970s, that under certain conditions these alloys could undergo the phenomenon known as breakaway oxidation. In this type of oxidation the rate limiting step is located at the oxide/metal interface rather than the more usual gas/oxide interface and results in linear oxidation kinetics. It has been shown that repeated removal of oxide layers can expose chromium depleted metal to the oxidising gas and promote nucleation of breakaway ox-

idation. The question has been addressed as to whether high temperature sliding wear processes can also disrupt the surface so as to make the material potentially susceptible to breakaway oxidation. To this end high temperature reciprocating wear of Fe-12Cr material in both low and high pressure reactor gas has been investigated.

4696 **(CONF-880760—5) Photothermal evaluation of diffusion coatings.** Gopalsami, N.; Rose, D.N.; Roberts, R.A.; Ellingson, W.A. (Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89000517/JAW.

From Review of progress in quantitative nondestructive evaluation; La Jolla, CA, USA (31 Jul 1988).

Chromized and chrome-aluminized coatings, applied to 2.25 Cr-1 Mo and 9 Cr-1 Mo steel substrates by a pack diffusion process, are being considered for advanced heat exchanger (heat recovery) systems of coal gasifiers. The materials used in this application are required to have good corrosion resistance and high mechanical strength for prolonged operation at high temperature. The combination of oxide-forming elements such as Cr and Al for corrosion perfection and low-alloy steels for mechanical strength provides an economically attractive solution. Pack-diffusion process is well suited to apply these coatings to large and complex-shaped components of heat exchangers. We have investigated the use of thermal-wave technique for evaluation of chromized steel tubes, which are candidate materials for coal-gasifier heat-recovery systems. By using a drilled hole, the usefulness of this technique for imaging surface and subsurface features of these coatings has been established. The use of this technique for deducing the chromium concentration profile in the coating requires detailed thermal modeling of the coating structure and knowledge of the thermal property changes of the coating with depth. 6 refs., 6 figs., 1 tab.

4697 **(CONF-8805134—5) Iridium ion implantation of surgical titanium alloy: Corrosion inhibition and charge injection effects.** Buchanan, R.A.; Lee, In-Seop; Williams, J.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01. Order Number DE89002225/JAW.

From Ion implantation and plasma assisted processes for industrial applications conference; Atlanta, GA, USA (21 May 1988).

Studies are described on the effects of iridium ion implantation on corrosion inhibition and charge-injection capabilities of surgical Ti-6Al-4V alloy. Iridium has been described as the most corrosion resistant element known, and its thermally activated oxide as having the highest charge-injection capability of any material known. Ti-6Al-4V samples, ion implanted with 2.5 and 5.0 atomic percent peak-maximum concentrations of Ir, were subjected to corrosion treatments, to enrich the surface with Ir. Corrosion potential and cyclic voltammetry measurements indicated enrichment in H_2SO_4, and continued enrichment in isotonic saline, with corrosion potentials approaching that of pure Ir, and charge densities in isotonic saline exceeding that of pure Ir for the 5.0% Ir peak-maximum material. X-ray photoelectron spectroscopy confirmed the high levels of Ir surface enrichment. 6 refs., 4 figs., 1 tab.

4698 **(DOE/ER/10963—8) Microstructural effects in abrasive wear: Final report for period September 15, 1981--March 14, 1986.** Kosel, T.H. (Notre Dame Univ., IN (USA). Dept. of Materials Science and Engineering). 8 Mar 1988. Contract AC02-81ER10963. 37p. NTIS, PC A03/MF A01. Order Number DE89003032/JAW.

This report summarizes research performed on abrasion of metallic alloys. The work was designed to improve our understanding of the factors affecting abrasion rates in two-phase alloys containing large, hard second-phase particles (SPPs) such as carbides, since this class of alloys generally has very high abrasion resistance owing to the presence of such carbides. The project was divided into sections dealing with material removal in the carbide and matrix phases. The materials studied included Stellite and high Cr-Mo white cast irons and a set of specially prepared model alloys containing one of six types of artificial SPPs dispersed in a sintered matrix of pure Cu. Scratch tests were employed to simulate abrasion mechanisms, and specially designed scratch test systems were fabricated to permit scratch testing in-situ in the scanning electron microscope (SEM) and to permit scratches to be made at fixed depths of cut rather than fixed loads. Three types of abrasion tests were employed; a dry-sand rubber wheel abrasion test; a low-speed "gouging" abrasion test employing a special low-speed Al_2O_3 grinding wheel; and a pin-on-disc abrasion test using abrasive paper. Abrasive type and size was varied in the rubber wheel and the pin-on-disc tests. 27 refs., 10 figs., 5 tabs.

4699 **(DOE/ER/45072—32) Scanning tunneling microscopy of charge-density waves in $NbSe_3$.** Slough, G.; Giambattista, B.; Johnson, A.; McNairy, W.W.; Coleman, R.V. (Virginia Univ., Charlottesville (USA). Dept. of Physics). [1988]. Contract FG05-84ER45072. 15p. NTIS, PC A03/MF A01. Order Number DE89003033/JAW.

The charge-density wave (CDW) structure in $NbSe_3$ due to the two independent CDWs has been imaged by scanning tunneling microscopy. As predicted by band structure considerations the CDW modulation is observed to be substantially localized on different chains for the separate CDWs. At 77K where only the high temperature CDW exists a relatively weak modulation with a single component along the {bar b}-axis is observed. At 4.2K the low temperature CDW contributes a much stronger {approximately}4{bar b}$_0$ {times} 2{rvec c}$_0$ superlattice modulation. The combination of atomic resolution and CDW modulations allows an unambiguous identification of the chain structure to be made. 9 refs., 5 figs.

4700 **(DOE/ER/45134—4) Electron hybridization effects and the crystal structure of plutonium: Progress report, January 1, 1987--May 31, 1988.** Cooper, B.R. (West Virginia Univ., Morgantown (USA). Dept. of Physics). 31 May 1988. Contract FG05-84ER45134. 6p. NTIS, PC A02/MF A01. Order Number DE89003059/JAW.

The main research effort during the past year was on the theory of surface electronic behavior of plutonium. This research was described in last year's Progress Report and deals with both development of the resonant band-f scattering theory for the magnetic properties of highly correlated actinide systems and the synthesis of band and model Hamiltonian theory for actinide systems. A summary of the results for the surface electronic behavior of plutonium are included.

4701 **(DOE/ER/45179—4) Mechanisms of the oxidation of metals and alloys: Annual progress report, 1 July 1987--30 June 1988.** Yurek, G.J. (Massachusetts Inst. of Tech., Cambridge (USA). Corrosion Lab.). 29 Aug 1988. Contract FG02-85ER45179. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003053/JAW.

This research is directed to studying the mechanisms of the high temperature oxidation of metals and alloys. During the last year, the research has focused on (1) the oxidation-sulfidation of Cr and Fe--Cr in H_2-H_2S and H_2-H_2O-H_2S gas mixtures, (2) the oxidation-sulfidation of rapidly solidified, austenitic alloys in SO_2 gas, and (3) the influence of the segregation of foreign ions to grain boundaries in oxide scales on oxidation resistance.

4702 **(EPRI-ER—6065) Sintering and creep of copper, nickel, and alloys: Final report.** Johnson, D.L. (Electric Power Research Inst., Palo Alto, CA (USA); Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering). Oct 1988. 61p. Research Reports Center, Box 50490, Palo Alto, CA 94303. Order Number TI89002062/JAW.

Reduced copper powder of a 2--4 μm size was mixed in a solution of aluminum nitrate or magnesium nitrate. A chemical reaction left amorphous aluminum oxide or magnesium oxide on the copper particle surfaces. The sintering process crystallized the oxide which was observed to have a spheroid particle morphology. The reacted powder was pressed into compacts and sintered under uniaxial loads in a reducing environment. Axial and radial shrinkages were followed simultaneously using linear differential dilatometers. Compacts with 0.1 wt % oxide were sintered between 584 C and 852 C, and compacts with oxide concentrations between 0.01 wt % and 0.1 wt % were sintered at 650 C. Densities of the compacts varied from an initial density of between 45 and 50% to over 70% of theoretical for the pure copper sintered at 584 C, and to

about 58% of theoretical for the compacts dispersed with 0.1% magnesia sintered at 852 C. The extent of densification decreased as the amount of alumina increased, but only for the pure copper compacts did an increase in applied load lead to an increase in densification at any given temperature. The increase in the axially applied load resulted in an increased axial strain and strain rate, and a decreased radial strain and strain rate for both the pure and dispersed compacts. 51 refs., 19 figs., 1 tab.

4703 **(FRCEA-TH—125) Study of austenitic stainless steel creep between 550/sup 0/C and 650/sup 0/C.** Arnaud, J.C. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie). Nov 1987. 127p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88756015/JAW.

This work is a contribution to identification and analysis of microscopic mechanisms of creep damages in austenitic stainless steels used for steam generators of fast neutron reactors. Statistical analysis of slip at the grain boundaries and tests on polycrystalline of alloy 800 grade II indicate the role of structural parameters: matrix reinforcement and boundary slip. Microstructure analysis shows the deformation mechanisms and the differences between steel 316 and alloy 800. In situ tests on bicrystalline samples of steel ZCN17/13 show the event chronology. Characteristic data on damaging at the nanometer scale (cavity size, crack dimensions) are determined. From these results a beginning of simulation is attempted for the two types of damage. 67 refs.

4704 (INIS-mf—11324, pp 95) **Crystallization of iron-rich metallic glasses owing to the neutron irradiation.** Sitek, J.; Miglierini, M. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4705 (INIS-mf—11328, pp 46) **Moessbauer spectroscopy investigations of the bcc-hcp phase transition in Zr/sub 80/Nb/sub 20/(Fe).** Vogl, G.; Yoshida, Y.; Fratzl, P.; Miekeley, W. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4706 (INIS-mf—11328, pp 23) **Measurements of thermophysical properties of liquid molybdenum.** Jaeger, H.; Pottlacher, G.; Kaschnitz, E. (Technische Univ. Graz, Institut fuer Experimentalphysik, Petersgasse 16, A-8010 Graz (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4707 (INIS-mf—11328, pp 43) **Influence of magnetic impurities on critical fields H/sub c2/ of LaAl/sub 2/ superconductors.** Vlcek, B.; Seidl, E.; Weber, H.W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4708 (KFK—4450, pp 134-151) **Growth of semi-elliptical surface cracks in a ferritic and an austenitic steel under thermal fatigue loading.** Bethge, K.; Munz, D.; Stamm, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung 4 - Zuverlaessigkeit/Schadenskunde). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

Theoretical and experimental investigations of crack growth under thermal and thermo-mechanical fatigue loading are presented. The experiments were performed with a ferritic pressure vessel steel 20 MnMoNi55 and an austenitic stainless steel X6CrNi1811. A plate containing a semi-elliptical surface crack is heated up to a homogeneous temperature and cyclically cooled down by a jet of cold water. On the basis of linear elastic fracture mechanics stress-intensity factors are calculated with the weight function method. The prediction of crack growth under thermal fatigue loading using data from standard specimens is compared with the experimental result.

4709 **(NP—9770010) Testing the HSCC resistance of welds performed on low-alloy steels. Final report.** Pircher, H.; Sussek, G. (Thyssen Stahl A.G., Duisburg (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 20 May 1987. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770010/JAW.

Dealt with are laboratory experiments in which various tests were conducted to examine whether and/or to what extent low-alloy steels are influenced by welding as regards their resistance to hydrogen-induced stress corrosion cracking (HSCC). The structure of the heat-affected zone, the hardness resulting from it, and the influence of the welding conditions are given special consideration in the evaluation of the corrosion tests. Discussed are tests on multi-pass welded joints, on single-pass bead-on-plate welds and on weld thermal simulated specimens executed with varying cooling times t/sub 8/5/. The tests were performed on low alloy C-Mn-steels of different composition. Constant load tests are conducted according to NACE Tm-01-77, and constant deflection tests according to Stahl Eisen Pruefblatt 1861, with H/sub 2/S-saturated NACE test solution of pH 3. The experiments show differences between constant load and constant deflection tests, which are dealt with in detail. The question of whether it is practical to limit the maximum hardness in the heat-affected zone to ensure against HSCC, is given critical examination. (orig.) With 12 refs., 19 figs.

4710 **(PNL-SA—14541) Microchemistry and mechanics issues in stress corrosion cracking.** Jones, R.H.; Danielson, M.J.; Baer, D.R. (Pacific Northwest Lab., Richland, WA (USA)). May 1987. Contract AC06-76RL01830. 48p. (CONF-870697—3). NTIS, PC A03/MF A01. Order Number DE89002004/JAW.

From 20. ASTM's national fracture mechanics conference: prospectives and directions; Leheigh, PA, USA (23 Jun 1987).

Environmentally induced subcritical crack growth occurs in most metallic materials given the appropriate material, environment and stress conditions. Much is known about the conditions which cause stress corrosion cracking (SCC) in metallic materials, but much less is known about the processes which control environment-induced crack initiation and propagation. There is presently no description of the flaw length, flaw shape and local chemistry conditions that coincide with the transition from a localized corrosion phenomenon and the initiation of a crack. While there have been considerable attempts to describe the rate-limiting steps in crack propagation, a number of issues are unresolved including specifics about the crack tip conditions, crack length effects, processes controlling the stage I SCC region and details about the crack advance processes in both transgranular stress corrosion cracking (TGSCC) and intergranular stress corrosion cracking (IGSCC). A summary of these unresolved issues and some analysis of their effect on SCC is given in this paper. 46 refs., 14 figs., 2 tabs.

4711 **(SAND—88-2261C) Oxygen and copper valencies in oxygen-doped superconducting La_2CuO/sub 4.13/.** Shinn, N.D.; Rogers, J.W. Jr.; Schirber, J.E.; Venturini, E.L.; Ginley, D.S.; Morosin, B. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-881002—24). NTIS, PC A02/MF A01. Order Number DE89003265/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

Oxygen enrichment of La_2CuO_4 by a high-temperature and high-pressure (1--3 kbar at 875K) treatment produces a stable, bulk superconductor, La_2CuO/sub 4.13/ (T/sub c/ ~ 30K). Annealing

in vacuum above 350K depletes the excess oxygen from La_2CuO/sub 4.13/ as O_2(g), eliminates the superconductivity, and results in semiconducting La_2CuO_4. These annealed samples were subsequently recharged with oxygen, thereby reversibly restoring the bulk superconductivity. X-ray photoelectron spectroscopy has been used to identify the oxygen and copper valencies which correlate with the bulk superconductivity in this interstitially-oxygen-doped perovskite material. An XPS O(1s) binding energy of 532.1 eV is measured for the excess oxygen which, with additional analytical and quantitative magnetization data, indicates that the predominant excess oxygen species is a superoxide ion O_2/sup {minus}/. The angular dependence of the O(1s) peak intensity indicates a near-surface concentration enrichment of the superoxide species. The majority copper valency is Cu(II) with a Cu(2p) binding energy of 933.0 +- 0.1 eV; however, evidence for a minority Cu(III) species with a Cu(2p) binding energy of 934.4 +- 0.2 eV is found only in the superconducting, oxygen-enriched material. 23 refs., 3 figs.

4712 **(Y—2394) An alternative model for the oxidation of copper.** Condon, J.B.; Cristy, S.S.; Kirkpatrick, J.R. (Oak Ridge Y-12 Plant, TN (USA)). Jul 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01. Order Number DE89002817/JAW.

The reaction of copper with oxygen is modeled by assuming that internal oxidation is the rate-limiting step in the reaction. This modeling successfully calculates the reaction rate without any parameters. It also calculates the profiles of the oxide layer as observed in secondary ion mass spectrometry using oxygen isotope labeling. Agreement of the rate calculations with the experimentally determined rates is excellent from 1050{degree}C down to about 80{degree}C. For this range of temperatures, the largest deviation from the experimental values is a factor of about 3. This is within the experimental scatter. In contrast, the best calculation that is obtained by the traditional product layer calculation deviates from the experimental values by a factor of about 1000. For this temperature range, the calculations and the experimental observations were compared by using the parabolic rate behavior. Below 80{degree}C, deviations are observed owing to the tendency of the oxidation to follow the rate behavior, which has been described as the "log-law." It is demonstrated that the log-law behavior is not a separate mechanism from the parabolic behavior. With the described model it does not require separate mathematics. Both parabolic and log-law behaviors are calculated from the same set of equations that describe the internal oxidation mechanism. 35 refs., 4 figs., 3 tabs.

4713 **(Y—2403) An x-ray diffraction study of the stress-induced martensitic phase transformation in the uranium-6.9 to 7.7 wt % niobium alloys.** Carpenter, D.A. (Oak Ridge Y-12 Plant, TN (USA)). Oct 1988. Contract AC05-84OS21400. 28p. NTIS, PC A03/MF A01. Order Number DE89002816/JAW.

X-ray diffraction data from polycrystalline uranium-niobium (U-Nb) alloys with compositions of 6.9 to 7.7 wt % niobium showed evidence of stress-induced $\gamma^0 \rightarrow \alpha''$ (tetragonal $\rightarrow$ monoclinic) phase transformations when specimens were deformed in tension. These transformations appeared almost continuously with respect to strain because lines from the γ^0 phase appeared to shift with increasing strain to positions near those expected for lines from the corresponding α'' phase. An analysis of these data and observations in previous studies indicate that the $\gamma^0 \rightarrow \alpha''$ stress-induced martensitic transformation was thermoelastic, and the data could best be explained by elastic accommodation coupled with a small, first-order, discontinuous change. 23 refs., 14 figs., 1 tab.

4714 **Formation of surface layers of icosahedral Al(Mn).** Knapp, J.A.; Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (US)). pp 415-426 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Surface layers of the icosahedral phase of Al(Mn) have been formed from thin, alternating Al/Mn layers deposited on Al or Fe surfaces by rapid electron-beam or laser melting, by ion beam mixing, and by solid-state diffusion. The electron beam and laser treatments are similar to other liquid quenching techniques used previously to form the phase, but have well defined temperature histories which allow us to place limits on the melting point of the icosahedral phase, the time needed for its nucleation from the melt, and its growth velocity. Ion beam mixing is a way of forming the icosahedral phase which is quite different from melt quenching; the phase is formed during ion beam mixing at temperatures of 100 - 200°C. For mixing at $\leqq$60C an amorphous phase with icosahedral short-range order is formed; this phase can be converted to the icosahedral phase by subsequent annealing. Formation of the icosahedral phase by reacting the as-deposited layers in the solid state is a new technique not previously reported. The results presented here place new restrictions on proposed structural and thermodynamic models for the icosahedral phase.

4715 **Phase transformations in nickel-aluminum alloys during ion beam mixing.** Eridon, J.; Rehn, L.; Was, G. (Univ. of Michigan, Dept. of Nuclear Engineering, Ann Arbor, MI (US)). pp 433-438 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The effect of ion beam mixing of nickel-aluminum alloys with 500 keV krypton ions has been investigated over a range of temperature, composition, ion dose, and post-irradiation thermal treatments. Samples were formed by alternate evaporation of layers of aluminum and nickel. A portion of these samples was subsequently annealed to form intermetallic compounds. Irradiations were performed at both room temperature and 80 K using the 2 MV ion accelerator at Argonne National Laboratory. Phase transformations were observed during both in situ irradiations in the High Voltage Electron Microscope (HVEM) at Argonne and also in subsequent analysis of an array of irradiated samples. Electron diffraction indicates the presence of metastable crystalline structures not present in the conventional nickel-aluminum phase diagram. Transformations occur at doses as low as 5 x 10/sup 14/ cm/sup -2/ and continue to develop as the irradiation progresses up to 2 x 10/sup 16/ cm/sup -2/. Layer mixing is followed through Rutherford Backscattering analysis. Samples are also checked with x-rays and Electron Energy Loss Spectroscopy (EELS). A thermodynamic argument is presented to explain the phase transformations in terms of movements on a free energy diagram. This analysis explains the interesting paradox concerning the radiation hardness of the NiAl phase and the amorphous structure of mixed Ni - 50% Al layers.

4716 **Ion beam mixing in binary amorphous metallic alloys.** Hahn, H.; Averback, R.S.; De la Rubia, T.D.; Okamoto, P.R. (Materials Science and Technology Div., Argonne National Lab., Argonne, IL (US)). pp 491-496 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Ion beam mixing (IM) was measured in homogenous amorphous metallic alloys of Cu-Er and Ni-Ti as a function of temperature using tracer impurities, i.e., the so called "marker geometry". In Cu-Er, a strong temperature dependence in IM was observed between 80 K and 373 K, indicating that radiation-enhanced diffusion mechanisms are operative in this metallic glass. Phase separation of the Cu-Er alloy was also observed under irradiation as Er segregated to the vacuum and SiO/sub 2/ interfaces of the specimen. At low-temperatures, the amount of mixing in amorphous Ni-Ti is similar to that in pure Ni or Ti, but it is much greater in Cu-Er than in either Cu or Er.

4717 **Ion implantation at elevated temperatures.** Lam, N.Q.; Leaf, G.K. (Argonne National Lab., 9700 S. Cass Ave., Argonne, IL (US)). pp 467-472 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

A kinetic model has been developed to investigate the syngergistic effects of radiation-enhanced diffusion, radiation-induced segregation and preferential sputtering on the spatial redistribution of implanted solutes during implantation at elevated temperatures. Sample calculations were performed for Al/sup +/ and Si/sup +/ ions implanted into Ni. With the present model, the influence of various implantation parameters on the evolution of implant concentration profiles could be examined in detail.

4718 **Binary and ternary amorphous alloys of ion-implanted Fe-Ti-C.** Follstaedt, D.M.; Knapp, J.A. (Sandia National Labs., Albuquerque, NM (US)). pp 473-478 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The microstructure of Fe implanted with up to 50 at .% C was found to consist of hexagonal iron carbide precipitates oriented with respect to the Fe matrix. For higher C concentrations, an amorphous phase forms. This concentration dependence is explained in terms of the lattice structure of the iron carbide. In Ti-implanted Fe, substitutional Ti was found in the bcc Fe lattice for concentrations $\leqq$ 15 at.% Ti. The work of others suggests that amorphous phases form for $\geqq$ 33 at .% Ti. These results are discussed in terms of concentration boundaries of the ternary Fe(Ti,C) amorphous phase. Ion beam alloying methods are currently being used to form metastable alloys, both for fundamental investigations of such alloys as well as for potential use to improve physical properties of components. An important consideration in metal alloys is what phase will form upon implantation; one aspect of this question is to determine when amorphous phases will form. Rules are currently being advanced to predict alloy systems which will yield amorphous phases.

4719 **Pulsed laser and ion beam surface modification of sintered alpha-SiC.** More, K.L.; Davis, R.F.; Appleton, B.R.; Lowndes, D.; Smith, P. (Dept. of Materials Engineering, North Carolina State Univ., Raleigh, NC (US)). pp 445-454 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Pulsed laser annealing and ion beam mixing have been used as surface modification techniques to enhance the physical properties of polycrystal-line α-SiC. Thin Ni overlayers (20 nm - 100 nm) were evaporated onto the SiC surface. The specimens were subsequently irradiated with pulses of a ruby or krypton fluoride (KrF) excimer laser or bombarded with high energy Xe/sup +/ or Si/sup +/ ions. Both processes are non-equilibrium methods and each has been shown to induce unique microstructural changes at the SiC surface which are not attainable by conventional thermal treatments. Under particular (and optimum) processing conditions, these changes considerably increased the mechanical properties of the SiC; following laser irradiation, the fracture strength of the SiC was increased by as much as 50%, but after ion beam mixing, no strength increase was observed. High resolution cross-section transmission electron microscopy (X-TEM), scanning electron microscopy (SEM), and Rutherford backscattering techniques were used to characterize the extent of mixing between the Ni and the SiC as a result of the surface modifications.

4720 **Heavy ion induced damage and disorder in intermetallic compounds with the B2 structure.** Brimhall, J.L.; Kissinger, H.E. (Pacific Northwest Lab., P.O. Box 999, Richland, WA (US)). pp 173-182 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

Although the B2-type intermetallic compounds, NiAl, FeAl, NiTi and FeTi all maintained a high degree of order during irradiation, metastable phase formation was observed. Dislocation loops and network developed in NiAl and FeAl during irradiation and a nickel rich, fcc phase, most likely disordered Ni/sub 3/Al, formed in NiAl after high doses. The build-up of constitutional vacancies (excess vacancies on Ni sites) and subsequent elemental partitioning of Ni and Al can explain the formation of a nickel rich phase in NiAl. No metastable phases formed in FeAl. Dislocation loop structures did not develop in NiTi or FeTi, rather a transformation to an amorphous phase occurred at relatively low doses. The amorphous transformation results when the free energy of the crystal lattice containing a high defect concentration exceeds the free energy of the amorphous configuration.

4721 **The disordering phase transformation in (Ni/sub 70/Fe/sub 30/)/sub 3/(V/sub 98-x/Al/sub x/Ti/sub 2/) alloys with O $\leqq$ x $\leqq$ 80.** Das Gupta, A.; Horton, J.A. (Metals and Ceramics Div., Oak Ridge National Lab., P.O. Box X, Oak Ridge, TN (US)). pp 117-124 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

The sequence of disordering transformation processes in the A/sub 3/B type alloy series (Ni/sub 70/Fe/sub 30/)/sub 3/(V/sub 98-x/Al/sub x/Ti/sub 2/), currently under development for high-temperature structural applications, was studied by differential scanning calorimetry (DSC), x-ray diffraction, optical microscopy, and transmission electron microscopy (TEM). Results of DSC show that in all alloys there are two endothermic stages of phase transformation from the ordered to the disordered state. With increasing chi, the disordering transition temperature, T/sub c/, reaches a maximum —1000°C at chi $\cong$ 50 and then decreases. Interrupted heating, followed by water quenching, was used to characterize the crystal structure and the microstructure of the intermediate phases. For the x = 20 alloy, TEM observations showed ordered regions of DO/sub 22/ phase in a matrix of disordered fcc (Al) phase at intermediate temperatures. The ordered domains transformed morphologically into cuboid like regions at higher temperatures. From a combined study by all the techniques, the authors conclude that in alloy with x between 0 and 20, the sequence of phase transformations from heating is: DO/sub 2/ $\rightarrow$ DO/sub 22/ + Al $\rightarrow$ Al, whereas in alloys with x > 40, the major sequence is Ll/sub 2/ + B/sub 2/ $\rightarrow$ Ll/sub 2/ + Al $\rightarrow$ Al.

4722 **Effects of DO/sub 3/ transitions on the yield behavior of Fe-Al alloys.** Inouye, H. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 255-262 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

The effect of DO/sub 3/ transitions on the yield behavior of alloys near the Fe/sub 3/Al composition was investigated by tensile tests. Above 400°C, DO/sub 3/ (Fe/sub 3/Al) ordered alloys exhibited an anomalous increase in yield strength with temperature with a peak value around 560 to 600°C which was not observed if the DO/sub 3/ ordered alloys were also aged before testing. This yield behavior is explained by the precipitation of α (disordered solid solution) and the formation of B/sub 2/ (FeAl) vai the sequential reactions: DO/sub 3/$\rightarrow\alpha$+DO/sub 3/$\rightarrow\alpha$+B/sub 2/.

4723 **High-temperature ordered intermetallic alloys.** Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). 560p. (CONF-8411308—). Materials Research Society, 9800 Mc Knight Rd., Suite 327, Pittsburgh, PA 15237.

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

This book contains over 40 selections. Some of the titles are: The oxidation of nickel-aluminum and iron-aluminum alloys; Ordering behavior and corrosion properties of Ni-Mo and Ni-Mo-Cr alloys; Magnetic studies of Ni/sub 3/Al(Fe) compounds; and The effects of grain size on the flow and fracture of long ranged-ordered alloys.

4724 **The effects of grain size on the flow and fracture of long-range ordered alloys.** Schulson, E.M. (Thayer School of Engineering, Dartmouth College, Hanover, NH (US)). pp 193-204 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

Three points usually come to mind when considering the effects of grain size on the mechanical properties of polycrystals: strengthening at low temperatures through grain refinement, strengthening at high temperatures through grain coarsening, and lowering of the ductile to brittle transition temperature in materials such as ferritic steels and zinc through grain refinement. Ordered alloys exhibit the same effects. In considering these effects, discussion is limited to short-term behavior. Long-term behavior, although of interest, appears not to have been examined for possible grain size effects. Emphasis is placed upon relatively recent observations and upon the behavior of the aluminides, a class of ordered intermetallic compounds which appear near the exploitation. The paper is not intended to be a critical review. Rather, it indicates general trends and shows that grain size can have significant effects on the mechanical properties of ordered alloys.

4725 **The production and thermal stability of a refined dispersion of Er/sub 2/O/sub 3/ in Ti/sub 3/Al using rapid solidification processing.** Konitzer, D.G.; Fraser, H.L. (Dept. of Metallurgy and the Materials Research Lab., Univ. of Illinois, 1304 W. Green St., Urbana, IL (US)). pp 437-444 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

The use of rapid solidification processing to produce a refined dispersion of second phase in Ti/sub 3/Al is demonstrated. Laser surface melting produces a disordered solid solution of Ti and Al with a supersaturation of Er and O. A refined dispersion of Er/sub 2/O/sub 3/ is formed on heat treatment at 973 K. This oxide is found to be stable at elevated temperatures up to 1173 K.

4726 **Design of ductile polycrystalline Ni/sub 3/Al alloys.** Liu, C.T.; White, C.L. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 365-380 of High-temperature ordered intermetallic alloys. Koch, C.C.; Liu, C.T.; Stoloff, N.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-8411308—).

From High-temperature ordered intermetallic alloys; Boston, MA, USA (26 Nov 1984).

This paper provides a comprehensive review of current efforts on design of ductile polycrystalline Ni/sub 3/Al alloys. Microalloying has proven to be very effective in alleviating the grain-boundary embrittlement problem. The ductility and fabricability of Ni/sub 3/Al (24 at. % Al) are dramatically improved by adding a few hundred parts per million of boron. The beneficial effect of boron is related to its unusual segregation behavior as predicted from the theory of grain-boundary cohesion developed by Rice, based on thermodynamic analyses. Alloy stoichiometry strongly influences grain-boundary chemistry, which, in turn, affects the boundary cohesion and overall ductility of Ni/sub 3/Al. The solid-solution hardening of Ni/sub 3/Al depends on the substitutional behavior of alloying elements, atomic size misfit, and the degree of nonstoichiometry of the alloy. Hafnium additions are very effective in improving high-temperature properties of ternary Ni/sub 3/Al (Al + Hf = 24 at. %) doped with boron. Alloying with $\leqq$ 2% Hf substantially increases the yield stress and raises the peak-strength temperature. In addition, hafnium substantially improves creep properties and oxidation resistance. The Ni/sub 3/Al aluminides truly represent a new series of heat resistant materials which do not depend on chromium for oxidation resistance.

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REFER ALSO TO CITATION(S) 4115, 4428, 4838, 4842, 5622

4727 **(CEA-R—5450) Thermal properties of mixed uranium and plutonium oxides.** Bonnerot, J.M. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 190p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755994/JAW.

The thermal conductivity of mixed oxide fuel (U,Pu)O/sub 2/ has been studied from 700 to 2000/sup 0/C. The effects of stoichiometry (O/M ratio) and plutonium content were analyzed from the published results and the discrepancies among the different authors has been shown. Before to modelize the thermal conductivity of the mixed oxide fuel, the heat transport mechanisms in the ceramic material was described and a physical model of conductivity as a function of temperature is proposed. The measurements of the thermal diffusivity on various (U,Pu)O/sub 2-x/ samples, by the flash laser technics, allowed to calculate the conductivity used for the modelization. These measures confirm the strong effect of the stoichiometry on the conductivity, but no significant effect of the plutonium content can be observed. A new analytical expression of the conductivity based on physics is suggested for the mixed oxide fuel of fast breeder reactors.

4728 **(CONF-881151—24) The annealing behavior of ion-implanted single crystals of the type YBa_2Cu_3O/sub x/.** McCallum, J.C.; White, C.W.; Boatner, L.A. (Oak Ridge National Lab., TN (USA)). Sep 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89002189/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Recent measurements have shown that the structural disorder induced by the implantation of ions into high-T/sub c/ superconducting oxides of the type YBa_2Cu_3O/sub x/ can lead to significant decomposition of the implanted region during subsequent thermal processing. We have used Rutherford backscattering spectrometry and ion channeling to examine the effects of ion implantation and thermal annealing on the near-surface composition of these materials. Our results indicate that the decomposition of the implanted region of YBa_2Cu_3O/sub x/ single crystals is associated with Ba migration and occurs for ion doses above a definite threshold when thermal anneals are carried out at temperatures greater than 500{degree}C in a variety of atmospheres (O_2, O_2 + H_2O, Ar). Importantly, we have also observed that the implanted crystals can be annealed in O_2 at a temperature of 850{degree}C with little decomposition of the implanted region occurring and that, under these conditions, the implantation-induced disorder is substantially removed. 14 refs., 3 figs.

4729 **(DOE/ER/45286—2) Fabrication, phase transformation studies and characterization of SiC-AlN-Al_2OC ceramics: Progress report, February 1, 1988--October 31, 1988.** Virkar, A.V. (Utah Univ., Salt Lake City (USA). Dept. of Materials Science and Engineering). 1988. Contract FG02-87ER45286. 5p. NTIS, PC A02/MF A01. Order Number DE89003081/JAW.

Work has progressed in three principal areas. These are: (1) Phase equilibria and transformation in AlN-Al_2OC pseudobinary system. Major effort was devoted in this area. (2) Creep of polycrystalline AlN. The stress and the grain size dependence of creep rate in polycrystalline AlN has been examined. It has been shown that creep is diffusion controlled. Electron microscopic examination of the samples subjected to creep deformation has shown that voids are nucleated at the grain boundaries and these tend to link up under continued loading. A manuscript based on this work is currently under preparation. (3) Microstructural development in SiC-AlN and its effect on creep behavior. The modulations have been observed to occur in two directions unlike in AlN-Al_2OC in which the modulations occur only in one direction, namely [001]. It has been observed that after long term annealing, the spinodally decomposed microstructure coarsens without causing grain growth. The

creep rate of spinodally decomposed SiC-AlN is lower than the corresponding solid solution. A brief summary of the work done to date is given in the following. 2 figs.

4730 **(DOE/ER/45325—1) Diffraction studies of the structure of glasses and liquids: Technical progress report.** Moss, S.C. (Houston Univ., TX (USA). Dept. of Physics). 1988. Contract FG05-87ER45325. 32p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003379/JAW.

Our in-house research activity during this period has centered mainly on our refinement of the relaxation and characterization of the Bell-Dean model for vitreous SiO_2 and on studies of the aggregation kinetics and fractal nature of amorphous melanin in colloidal suspension. The SiO_2 work, summarized below, is now completed. The melanin program is doing well and we shall begin in-house x-ray studies of the structure of the precipitated material. The development of the glass and liquid diffractometer (GLAD) proceeds apace at Argonne. Continued input on this design is being analyzed and incorporated into the construction.

4731 **(INIS-BR—1300) Phase equilibria in the system Zr O/sub 2/ - FeO - Fe/sub 2/O/sub 3/ at Po/sub 2/ = 2.10 /sup -3/ atm.** Kiminami, A. (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 10p. (In Portuguese). (CONF-8804217—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704778/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

The system ZrO/sub 2/ - FeO - Fe/sub 2/O/sub 3/ was analysed by thermogravimetry under reduced oxygen pressure (Po/sub 2/ = 2.10/sup -3/ atm) and temperatures up to 1380/sup 0/C. It was show that at Po/sub 2/ = 2.10/sup -3/ atm the oxidation reactions are faster than at Po/sub 2/ = 0,21 atm (1). It was concluded that about 2 mol% Fe/sub 2/O/sub 3/ are soluble in Fe/sub 2/O/sub 3/ bringing up a sharp increase in the dissociation temperature of the 3Fe/sub 2/O/sub 3/ -> 2Fe/sub 3/O/sub 4/ + 1/20/sub 2/ reaction four 1265/sup 0/C to 1300/sup 0/C and that about 8 Mol% Fe/sub 2/O/sub 3/ are soluble in Z four 1265/sup 0/C to 1300/sup 0/C and that about 8 Mol% Fe/sub 2/O/sub 3/ are soluble in ZrO/sub 2/ under these conditions.

4732 **(INIS-BR—1322) Optimization of the conditions for producing zirconia by the precipitation of basic zirconium sulfate.** Ricci, D.R.; Paschoal, J.O.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). (Associacao Brasileira de Ceramica, Sao Paulo). 1988. 31p. (In Portuguese). (CONF-8804217—). V03/MF A01. Order Number DE88704782/JAW.

From 32. Brazilian congress on ceramics; Natal, Brazil (24 Apr 1988).

The process of precipitation of the basic sulfate from zirconium oxychlorides solutions has been optimized in order to obtain zirconia of high purity as well as suitable for ceramic processing. The main parameters of this study were obtained from the determination of the pH and of the concentration of the initial oxychloride solution, of the sulfate/zirconium molar ratio and of the reaction temperature. The following experimental procedure has been carried out: a) reaction of each precipitate with ammonium hydroxide followed by drying at 150/sup 0/-C / 5 h and calcination at 1000/sup 0/C / 1 h, yielding the final product (zirconia) b) product characterization by means of spectrographic, X - ray fluorescence and diffractometry analyses, determination of grain size distribution and of apparent density, and morphology study by scanning electron microscopy. The yielding of the overall reaction has been determined by chemical analysis and the composition of the basic zirconium sulfate by thermogravimetric analyses.

4733 (INIS-mf—11328, pp 21) **Raman spectroscopic investigation in several ceramic super-conductors based on Bi-CaBaCuO.** Faulques, E.; Kuzmany, H.; Knoll, P. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik; Graz Univ., Institut fuer Experimentalphysik, Universitaetsplatz 5, A-8010 Graz (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4734 (INIS-mf—11328, pp 25) **Cu/Zn substitution in La/sub 1.85/Sr/sub 0.15/CuO/sub 4/ and YBa/sub 2/Cu/sub 3/O/sub 7/.** Hilscher, G.; Pillmayr, N.; Bauer, E.; Eibler, R.; Remschnig, K.; Rogl, P. (Technische Univ., Vienna (Austria). Inst. fuer Experimentalphysik; Vienna Univ. (Austria). Inst. fuer Physikalische Chemie). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4735 (INIS-mf—11328, pp 34) **Raman- and infrared spectroscopy of Tl high-temperature superconductors.** Kuzmany, H.; Matus, M.; Neugebauer, H.; Pekker, S. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik; Vienna Univ. (Austria). Inst. fuer Physikalische Chemie; Central Research Institute for Physics, Budapest (Hungary)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4736 (INIS-mf—11328, pp 41) **Fabrication and characterization of superconducting Y-Ba-Cu-O sputtered layers.** Springholz, G.; Leising, G.; Abt, R.; Leitner, O.; Kranebitter, P.; Poelt, P. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik; Zentrum fuer Elektronenmikroskopie, Steyrergasse 17, A-8010 Graz (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4737 (INIS-mf—11328, pp 13) **Experiments on high temperature superconductors.** Weber, H.W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4738 (INIS-mf—11328, pp 18) **High-temperature superconductors without rare earth atoms.** Abt, R.; Leitner, O.; Pang, Y.; Pressl, K.; Schweiger, E.; Wippel, V.; Leising, G. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4739 (INIS-mf—11328, pp 27) **Electric conductivity, magnetic susceptibility and infrared spectra in the Bi-Sr-Ca-Cu-O and the Tl-Ba-Ca-Cu-O systems.** Gruber, H.; Krautz, E.; Fritzer, H.P.; Gatterer, K.; Sitte, W.; Popitsch, A. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik; Technische Univ., Graz (Austria). Inst. fuer Physikalische und Theoretische Chemie; Graz Univ. (Austria). Inst. fuer Anorganische und Analytische Chemie). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4740 (INIS-mf—11328, pp 31) **Micro Raman scattering from single crystalline high temperature superconductors.** Knoll, P. (Graz Univ., Institut fuer Experimentalphysik, Universitaetsplatz 5, A-8010 Graz (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4741 (INIS-mf—11328, pp 31) **Oxygen induced phase changes in YBa/sub 2/Cu/sub 3/O/sub 6+δ/.** Kuzmany, H.; Matus, M.; Faulques, E.; Pekker, S. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik; Central Research Institute for Physics, Budapest (Hungary)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4742 (INIS-mf—11328, pp 32) **Magnetic susceptibility of the high-temperature superconductor YBaCuO.** Lang, W. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4743 (INIS-mf—11328, pp 33) **Infrared reflection from the high-temperature superconductor YBaCuO.** Markowitsch, W.; Lang, W. (Vienna Univ. (Austria). Inst. fuer Festkoerperphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4744 (INIS-mf—11328, pp 38) **Magnetization of single crystalline high-temperature super-conductors.** Sauerzopf, F.M.; Weber, H.W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4745 (INIS-mf—11328, pp 44) **Anisotropy of the lower critical magnetic fields H/sub c1/ and the critical currents j/sub c/ in textured HoBa/sub 2/Cu/sub 3/O/sub 7-6/ superconductors.** Wacenovsky, M.; Seidl, E.; Weber, H.W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4746 **(SAND—88-1248C) Issues on oxynitride films.** Stein, H.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-881061—7). NTIS, PC A03/MF A01. Order Number DE89002363/JAW.

From Electrochemical Society fall meeting; Chicago, IL, USA (9 Oct 1988).

Compositions and related properties for oxynitride films formed by various methods are reviewed. In chemical-vapor-deposited films, Si-N vibrational absorption is sensitive to changes in local bonding introduced by small percentages of oxygen in silicon nitride. Elemental analysis and infrared absorption indicate that nitridation of thin oxide films produces oxynitride layers with compositions approaching Si_2N_2O. Hydrogen is an important constituent in films and film stacks. In nitride oxide films, hydrogen in the presence of N is associated with electron traps. Optimization of nonvolatile memory characteristics of oxynitride-oxide-Si stacks by hydrogenation involves alteration of the near interface region in the oxynitride, passivation of Si/Si_2O interface states, and possible regrowth of the Si/Si_2O interface. Consistent trends involving diffusion chemical changes and layer differentiation during high temperature processing occur for films of different origins and compositions. 41 refs., 13 figs., 1 tab.

4747 **(SAND—88-1433C) Development of tin oxide coatings for use as electrodes in mercuric iodide photodetector applications.** Hays, A.K.; Hughes, R.C. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-8810203—1). NTIS, PC A03/MF A01. Order Number DE89001853/JAW.

From International symposium on combustion and plasma synthesis of high temperature materials; San Francisco, CA, USA (23 Oct 1988).

We determine plasma processing parameters for depositing thin, conductive, tin oxide films on HgI_2 substrates at relatively low temperatures. In addition, we report relative quantum efficiency measurements as a function of wavelength for HgI_2 photodetectors possessing plasma-deposited electrodes. 16 refs., 5 figs.

4748 **(SAND—88-2692C) Magnetization, transport and structural studies of Tl-Ca-Ba-Cu-O: Bulk ceramics, single crystals, and polycrystalline thin films.** Venturini, E.L.; Kwak, J.F.; Ginley, D.S.; Morosin, B.; Baughman, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 21p. (CONF-8810147—1). NTIS, PC A03/MF A01. Order Number DE89003264/JAW.

From Workshop on the materials science of high-{Tc} superconductors: magnetic interactions; Gaithersburg, MD, USA (11 Oct 1988).

A detailed investigation of the Tl-Ca-Ba-Cu-O system of high temperature superconductors is presented including static magnetization, electrical transport, structural and processing data for sintered and melted bulk ceramics, single crystals, and polycrystalline thin films. This system is shown by x-ray diffraction and energy dispersive x-ray analysis to have at least five distinct superconducting phase containing either two or three Cu-O sheets separated by one or two Tl-O planes. Bulk ceramic Tl-2223 has a Meissner effect up to 124 K and zero resistance up to 120 K, but transition temperatures are found to be a strong function of processing even for single crystals. Magnetization versus field data suggest weak flux pinning in all samples above 30 K. Melt processed bulk ceramics of Tl-2223 have transport critical current densities >5000 A/cm^2 at 76 K with modest magnetic field dependence, indicating strong intergranular links which are not present in Y-123. This is also observed for unoriented polycrystalline thin films. Tl-2223 films have critical current densities at 76 K up to 240,000 A/cm^2 with a modest dependence on in-plane magnetic fields, implying negligible effects of grain boundary Josephson junctions. 29 refs., 9 figs., 1 tab.

4749 **(SAND—88-2864C) Photodeflection and photoconductivity studies in ceramics.** Seager, C.H. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 13p. (CONF-8810195—3). NTIS, PC A03/MF A01. Order Number DE89002186/JAW.

From 41. Pacific coast regional meet of American Ceramic Society; San Francisco, CA, USA (24 Oct 1988).

Sensitive calorimetric techniques such as photothermal deflection spectroscopy (PDS) offer many advantages over conventional transmission spectroscopy for measuring the optical properties of ceramics. Insensitivity to light scattering is of particular importance for optical studies of these materials. The physics of the PDS method will be briefly reviewed as well as the experimental arrangement necessary to carry out sensitive (3 - 5 ppM) determinations of absorptance on ceramic specimens over a wide range of photon energies. Examples will be given of PDS studies on PLZT and doped ZnO ceramics. In the latter case coupled PDS/photoconductivity measurements have given new insights into the role of impurities added to optimize the electronic properties of ZnO varistors. 16 refs., 4 figs.

4750 **Aluminum cladding of high T/sub c/ superconductor by thermocompression bonding.** Richardson, T.J.; DeJonghe, L.C. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Applied Physics Letters;* **53**: No. 23, 2342-2343(5 Dec 1988).

Thermocompression bonding of aluminum to YBa_2Cu_3O/sub 7-//sub x/ (YBCO) has been demonstrated. The superconductor is

protected by a thin barrier layer of silver. The specific resistivity of the Al/Ag/YBCO interface was measured at 77 K as a function of current density and is below 3.2 x 10/sup -5/ Ω cm² for electrode current densities of at least 400 A cm/sup -2/ . This technique provides a convenient means of cladding bulk superconducting ceramics with a strong, inexpensive, and highly conductive metal.

4751 **Short-range ordering due to displacements of thallium and oxygen atoms in superconducting $Tl_2Ba_2CaCu_2O_8$ observed by pulsed-neutron scattering.** Dmowski, W.; Toby, B.H.; Egami, T.; Subramanian, M.A.; Gopalakrishnan, J.; Sleight, A.W. (Department of Materials Science and Engineering, and Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6272). *Physical Review Letters;* **61**: No. 22, 2608-2611(28 Nov 1988).

The atomic positional correlations in superconducting $Tl_2Ba_2CaCu_2O_8$ were studied by pair distribution function analysis of the pulsed-neutron scattering data. The results show for the first time strongly correlated local displacements of both thallium and oxygen atoms in the Tl-O plane from the high-symmetry crystallographic sites. As a consequence of the displacements Tl atoms form chains or pairs accompanied by displacement of nearby oxygen atoms, resulting in locally orthorhombic order. The ordering, however, remains very much short range and does not alter the average symmetry. The implications of these results with regard to the superconductivity of these oxides are discussed.

4752 **Fermi surface, ground-state electronic structure, and positron experiments in $YBa_2Cu_3O_7$.** Bansil, A.; Pankaluoto, R.; Rao, R.S.; Mijnarends, P.E.; Dl-dash-barugosz, W.; Prasad, R.; Smedskjaer, L.C. (Department of Physics, Northeastern University, Boston, Massachusetts 02115). *Physical Review Letters;* **61**: No. 21, 2480-2483(21 Nov 1988).

We present the calculations of electron-positron momentum density in $YBa_2Cu_3O_7$ based on band theory in the local-density approximation. Theoretical predictions are in semiquantitative accord with the corresponding two-dimensional positron-annihilation angular-correlation measurements. These results indicate that the conventional local-density-approximation band-theory picture provides a reasonable description of the ground-state electronic structure and the Fermi surface of $YBa_2Cu_3O_7$. Several Fermi-surface—related features are suggested in the positron spectra for the first time.

3606 Other Materials

REFER ALSO TO CITATION(S) 4204, 4204, 4280, 4496, 4716, 4719, 4730, 4747, 4810, 4849, 4853, 5115, 5115, 5147, 5347, 5568, 5583, 5614, 5618, 5623

4753 **(CONF-881155—6) Fabrication and mechanical properties of Ni_3Al--Al_2O_3 composites.** McKamey, C.G.; Povirk, G.L.; Horton, J.A.; Tiegs, T.N.; Ohriner, E.K. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003105/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

The objective of this study is to develop a metal-matrix composite based on the intermetallic alloy Ni_3Al reinforced with Al_2O_3 fibers, with improved high-temperature strength and lower density compared to the matrix material. This paper summarizes results of initial fabrication and mechanical tests on specimens produced using IC-15[Ni-24% Al-0.24% B (at.%)] and IC-218 [Ni-16.5% Al-8% Cr-0.4% Zr-0.1% B (at.%)], with 20 vol. % Al_2O_3 fibers. Fabrication methods include both hot-pressing and hot-extrusion. Mechanical tests include four-point bending and tensile tests. The integrity of the fiber-matrix interface was studied and correlated with mechanical properties. Tensile ductilities of approximately 10% at room temperature were achieved for Ni_3Al/Al_2O_3 composites with controlled material processing and interfacial structure. Fabrication of composites by hot-extrusion produced better tensile properties at room temperature, but superplastic behavior (i.e., low strengths, high ductilities) at 1000{degree}C. 9 refs., 3 figs., 2 tabs.

4754 **(CONF-8806103—4) Forced chemical vapor infiltration fabrication of SiC/SiC composites.** Stinton, D.P.; Lowden, R.A.; Besmann, T.M.; Starr, T.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE89001694/JAW.

From International conference on whisker- and fiber-toughened ceramics; Oak Ridge, TN, USA (7 Jun 1988).

Composites consisting of silicon carbide matrices reinforced with ceramic fibers, whiskers, or platelets have been fabricated by forced-chemical vapor infiltration (FCVI). Processing of composites reinforced with Nicalon fibers by FCVI has been optimized after many years of study. The material exhibits adequate flexure strengths and high-fracture toughness values. Models are described that have improved the understanding of the infiltration process and will be used to better control the process. Utilizing the increased understanding of the process developed through the modeling efforts, a limited number of composites were produced from alternative reinforcements. Preliminary mechanical property measurements of these materials indicated lower strengths and less fracture toughness than composites reinforced with Nicalon fibers. 21 refs., 12 figs., 4 tabs.

4755 **(DOE/ER/01198—2456) What insight into radiation effects can be gained by performing the irradiations and electron microscopy in the same instrument?.** Vetrano, J.S.; Bench, M.W.; Robertson, I.M.; Kirk, M.A. (Illinois Univ., Urbana (USA). Dept. of Materials Science and Engineering). 1988. Contract AC02-76ER01198;W-31109-ENG-38. 26p. (CONF-880901—7). NTIS, PC A03/MF A01. Order Number DE89001870/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

The High-Voltage Electron Microscope (HVEM)-Accelerator Facility at Argonne National Laboratory has been used to gain insight into the process of collapse of displacement cascades to vacancy loops in metals and the radiation induced crystalline-amorphous transition in GaAs. The facility allows an ion beam from either a 300 keV or a 2 MeV tandem accelerator to be directed to the sample chamber of an electron microscope. The coupling provides the experimentalist with the unique capability of performing heavy-ion irradiations and the subsequent microstructural characterization in one instrument at temperatures from 10 to 1000K. Key results are presented to demonstrate the benefit of this facility to the radiation effects community. 24 refs., 8 figs.

4756 **(DOE/ER/45210—1) The formation of ordered microstructures by slip casting and related processes: Progress report.** Russel, W.B. (Princeton Univ., NJ (USA). Dept. of Chemical Engineering). Oct 1988. Contract FG02-85ER45210. 9p. NTIS, PC A02/MF A01. Order Number DE89003077/JAW.

Our work has addressed the formation of ordered or crystalline dense phase during the sedimentation of hard sphere colloidal particles. The experiments employ silica dispersions bearing grafted octadecyl chains and dispersed in cyclohexane to achieve both the hard sphere behavior and index matching. The behavior during gravity settling is easily monitored optically, to track discontinuities and crystal boundaries, and by x-ray scanning, to detect the density as a function of position and time. The theoretical description adds the osmotic pressure which supports particles in the dense sediment to the gravitational and viscous forces included in conventional descriptions to predict the evolution of the concentration profiles. Crystallization kinetics are incorporated through the simple classical theory for single particle addition to a crystal front. The constitutive relations for the sedimentation velocity, the osmotic pressure, the self diffusion coefficient, and the chemical potential are taken from independent experiments or theories.

4757 **(DOE/PR/06010—T37) Thermophysical property measurements in fluid mixtures: Final report, Prepared for the period ending October 31, 1987.** (National Inst. of Standards and Technology, Gaithersburg, MD (USA). Thermophysics Div.). 20 Sep 1988. Contract AI01-76PR06010;AT01-82ER12045. 6p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003281/JAW.

Five years ago, the Center for Chemical Engineering of the National Bureau of Standards began a major program to upgrade its experimental capability in fluid property measurement. During the past five years great strides have been taken in improving and upgrading measurement capability at the two NBS sites. The apparatus that have been built under DOE sponsorship and that are now in routine operation are listed.

4758 (INIS-mf—11328, pp 64) **Phase transitions in polymethylmethacrylate studied by positron lifetime measurements.** Kindl, P.; Reiter, G. (Technische Univ., Graz (Austria). Inst. fuer Kernphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4759 (INIS-mf—11328, pp 61) **Radiolyoluminescence, its measurement and possible applications.** Wergles, K.; Nowotny, R.; Hille, P. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4760 (INIS-mf—11328, pp 51) **Phototransfer in quartz.** Reichhalter, I.; Vana, N. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4761 **(Juel—2177) Investigation of the surface states of the Si(001)-surfaces by means of the Kelvin method.** Reese, E. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Grenzflaechenforschung und Vakuumphysik; Duesseldorf Univ. (Germany, F.R.)). Jan 1988. 110p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755417/JAW.

The contact potential difference (CPD) and the surface photovoltage (SPV) were measured by the Kelvin technique on the clean and hydrogenated Si(001)-surface. The measurements of the photovoltage were carried out on a weakly n-doped (N/sub d/ $\simeq$ 10/sup 13/ cm/sup -3/) and on a weakly p-doped (N/sub a/ $\simeq$ 10/sup 14/ cm/sup -3/) sample in dependence of light intensity and temperature. In addition, measurements were made on the variation of the work function in the dark with temperature and doping. (orig./BHO).

4762 **(LA-UR—88-2705) Poly(vinyl pyridine)-based stabilizers for aqueous polypyrrole latices.** Armes, S.P.; Aldissi, M.; Agnew, S.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 12p. (CONF-8806264—1). NTIS, PC A03/MF A01. Order Number DE88016219/JAW.

From ICSM '88; Santa Fe, NM, USA (25 Jun 1988).

The preparation and characterization of sub-micronic polypyrrole latex particles using polymeric stabilizers based on poly(vinyl pyridine) is described. These novel colloidal dispersions enhance the usually limited processability of the electroactive component, and in addition exhibit usefully high solid-state conductivity, despite the presence of the insulating stabilizer component. Furthermore, these latices exhibit reversible base/acid induced flocculation-stabilization behavior. The latter phenomenon is of fundamental interest and is expected to have commercial applications. The latices were characterized by transmission electron microscopy, visible absorption spectroscopy, FTIR and Raman spectroscopy, microanalysis, and compressed pellet dc conductivity. Base-induced particle flocculation was studied as a function of latex particle concentration. 24 refs., 4 figs., 2 tabs.

4763 **(LBL—25067) Characterization of newly synthesized novel graphite films.** Krishnan, K.M.; Kouvetakis, J.; Sasaki, T.; Bartlett, N. (Lawrence Berkeley Lab., CA (USA)). May 1988. Contract AC03-76SF00098. 8p. (CONF-880408—40). NTIS, PC A02/MF A01. Order Number DE89001261/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, United States (4 Apr 1988).

Reactions of C_6H_6 and BCl_3 at 800{degree}C yields a metallic graphite-like material of composition BC/sub x/(3.0 $\leq$ x $\leq$ 4.00) while reactions of BCl_3, NH_3 and C_2H_2 produces a B/C/N graphitic semiconductor of approximate stoichiometry B_2CN_2. Both materials were shown to be homogeneous using Auger electron spectroscopy and extensively characterized by electron energy-loss spectroscopy. Single loss profiles of the EELS data were obtained using the fourier-log deconvolution method. Compositions were determined using hydrogenic cross-sections. A careful study of the plasmon resonance energies and the fine structures of the core-loss edges of these materials has been invaluable in demonstrating that the boron, carbon and nitrogen atoms are all sp^2 hybridized. Therefore, these new materials are in-sheet graphite hybrids and not intercalations. 6 refs., 2$\frac{1}{2}$ figs., 1 tab.

4764 **(NUREG/CR—5108) Thermodynamic properties of Tc(IV) oxides: Solubilities and the electrode potential of the Tc(VII)/Tc(IV)-oxide couple.** Meyer, R.E.; Arnold, W.D.; Case, F.I.; O'Kelley, G.D. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; Oak Ridge National Lab., TN (USA)). May 1988. Contract AC05-84OR21400. 25p. (ORNL—6480). NTIS, PC A03/MF A01 - GPO. Order Number TI88010693/JAW.

Solubilities of precipitated Tc(IV) oxides have been determined in solutions of NaCl in the pH range 7 to 9. Technetium oxide was prepared by precipitation upon purified sand with a 30% excess of hydrazine. The oxide-covered sand was then transferred to a small column, and solutions of NaCl varying in concentration from 0.1 mol/L to 2.6 mol/L were continuously cycled through the column. The concentrations of total technetium and Tc(IV) species in the solutions were periodically determined by separating the oxidized and reduced technetium species with a solvent extraction procedure and counting the beta activity of the ^{99}Tc with a liquid scintillation counter. The concentrations of Tc(IV) species in equilibrium with the oxide were approximately constant in the NaCl concentration range 0.1 mol/L to 2.6 mol/L and averaged (2.61 +- 1.00) {times} 10/sup {minus}9/ mol/L. A solubility product of (1.63 +- 0.62) {times} 10/sup {minus}33/ was calculated from the measured solubilities of Tc(IV) oxide. These data can be used to estimate Tc(IV) solubilities for cases where solubility limits transport of technetium in reducing environments of high-level waste repositories. 24 refs., 4 figs., 7 tabs.

4765 **(PB—88-246434/XAB) Evaluation of new asphalt concrete density specification. Final report, July 1987-June 1988.** Maupin, G.W. (Virginia Transportation Research Council, Charlottesville (USA)). Jun 1988. 20p. (VTRC—88-R30). NTIS, PC A03/MF A01.

The purpose of the investigation was to evaluate a new asphalt concrete density specification that utilizes a nuclear gauge and a control strip technique. The specification was studied on two field projects, and recommendations were made to improve it. The recommendations were to eliminate the correction factor, increase the number of density determinations, adopt a uniform policy in establishing the Marshall density, and provide instruction concerning roller patterns.

4766 **(SAND—88-2130) (AlGa)As/(InGa)As strained-quantum-well FETs [field-effect transistors] on silicon dioxide by selective device lift-off as an alternative to heteropitaxy.** Myers, D.R.; Klem, J.F.; Lott, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-881234—). NTIS, PC A02/MF A01. Order Number DE88017116/JAW.

From International electron devices meeting; San Francisco, CA, USA (11 Dec 1988).

We have successfully applied a selective lift-off technique, originally developed for minimally strained (AlGa)As/GaAs films, to transfer 1-μm gate-length depletion-mode (AlGa)As/(InGa)As strained-quantum-well field-effect transistors (FETs) from GaAs substrates to glass slides. Peak transconductance of the transistors was unchanged by the transfer. As an alternative to hetero-epitaxial growth, this new technique provides improved flexibility for the realization of complex hybrid electronic or optoelectronic systems. 7 refs., 2 figs.

4767 **(SAND—88-2754C) Compatibility study of an absorber material and two silicone adhesives.** Martinez, R.J.; Guess, T.R.; Gillen, K.T. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 8p. (CONF-8810151—7). NTIS, PC A02/MF A01. Order Number DE89002361/JAW.

From JOWOG-28 meeting; Albuquerque, NM, USA (1 Oct 1988).

A radar absorbing material, CMS-184, and assemblies bonded with two silicone based structural adhesives, DC-577 and RTV-630, were subjected to limited accelerated aging conditions and then evaluated for degradation of mechanical properties and adhesion, respectively. Aging conditions likely to be equivalent to 150 to 750 years at 72{degree}F and 100% RH only slightly changed the tensile strength and failure strain of CMS-184 (initial modulus remained unchanged). The RTV-630 adhesive performed better than DC-577 adhesive in butt tensile tests of unaged and aged specimens. Based on the results of these accelerated aging studies, both the CMS-184 absorber material and the RTV-630 adhesive should survive the expected life of current weapon systems. 3 tabs.

4768 **(SRD-R—439-Issue-2) Guidelines for the design and assessment of concrete structures subjected to impact.** Barr, P. (ed.). (UKAEA Safety and Reliability Directorate, Culcheth). Mar 1988. 36p. H.M. Stationery Office, London, price Pound 5.00.

This document presents techniques, which are advisory rather than mandatory, for designing and assessing the impact behaviour of concrete structures. These recommended techniques are based on extensive studies carried out by UKAEA, CEGB and NNC and on work in France, Germany and the USA. Studies of the impact behaviour of concrete are continuing, and a revised version of this document will be reissued early each year to include the most up to date information.

4769 **Raman scattering characterization of high-quality Cd/sub 1-//sub x/Mn/sub x/Te films grown by metalorganic chemical vapor deposition.** Feng, Z.C.; Sudharsanan, R.; Perkowitz, S.; Erbil, A.; Pollard, K.T.; Rohatgi, A. (Department of Physics, Emory University, Atlanta, Georgia 30322). *Journal of Applied Physics;* **64**: No. 12, 6861-6863(15 Dec 1988).

Cd/sub 1-//sub x/Mn/sub x/Te films (thickness ~0.5 μm, x = 0.10—0.37) have been grown by metalorganic chemical vapor deposition on commercial GaAs and glass substrates with and without buffer layers of CdTe and CdS. Raman scattering shows the films to be of high quality, despite the large film-substrate lattice mismatch. CdTe-like and MnTe-like phonon lines are sharp and strong in first and second order with widths $\leqq 10$ cm^{-1}, and clearly appear in combinations up to fourth order. Raman and photoluminescence analysis also establish an optimum growth temperature and limits on the fraction of Mn.

4770 **Infrared absorption study of neutron-transmutation-doped germanium.** Park, I.S.; Haller, E.E. (Department of Materials Science, University of California at Berkeley and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **64**: No. 12, 6775-6779(15 Dec 1988).

Using high-resolution far-infrared Fourier transform absorption spectroscopy and Hall effect measurements we have studied the evolution of the shallow acceptor and donor impurity levels in germanium during and after the neutron transmutation doping process. Our results show unambiguously that the gallium acceptor level concentration equals the concentration of transmutated /sup 70/ Ge atoms during the whole process indicating that neither recoil during transmutation nor gallium-defect complex formation play significant roles. The arsenic donor levels appear at full concentration only after annealing for 1 h at 450 °C. We show that this is due to donor-radiation-defect complex formation. Again recoil does not play a significant role.

4771 **Tensile stress variations of chemically etched GaAs films grown on Si substrates.** Lee, H.P.; Liu, X.; Lin, H.; Smith, J.S.; Wang, S.; Huang, Y.; Yu, P.; Huang, Y. (Department of Electrical Engineering and Computer Sciences and Electronics Research Laboratory, University of California, Berkeley, California 94720). *Applied Physics Letters;* **53**: No. 24, 2394-2396(12 Dec 1988).

Photoluminescence (PL) at 77 K is used to study tensile stress variations in chemically etched stripes of a 3-μm-thick GaAs film grown on Si substrate. The etched patterns consist of 1-mm-long stripes with widths ranging from 100 to 4 μm and 4 μm by 4 μm squares. We observed monotonic shift of PL peaks towards shorter wavelength for decreasing stripe width. In particular, when the width of the stripe is less than 7 μm, tensile stress is essentially uniaxial as evident from the magnitude of shift in PL peaks. The polarization characteristics of the PL spectra of these uniaxially stressed stripes are investigated and found to agree well with theoretical predictions.

4772 **Impurity-induced layer disordering of In/sub 0.53/Ga/sub 0.47/As/In/sub 0.52/Al/sub 0.48/As heterostructures.** Baird, R.J.; Potter, T.J.; Lai, R.; Kothiyal, G.P.; Bhattacharya, P.K. (Ford Motor Company, Research Staff, P. O. Box 2053, Dearborn, Michigan 48121-2053). *Applied Physics Letters;* **53**: No. 23, 2302-2304(5 Dec 1988).

Impurity-induced layer disordering of In/sub 0.53/ Ga/sub 0.47/ As/In/sub 0.52/ Al/sub 0.48/ As heterostructures grown by molecular beam epitaxy has been observed by Auger electron spectroscopy depth profiling. We find that Si^+ ion implantation to concentrations greater than 2 x 10^{19} atoms cm^{-3} enhances the intermixing of Ga and Al in these heterostructures at an annealing temperature of 1075 K. However, the relatively high temperature which is required to activate the interdiffusion of Ga and Al in the region of high Si concentration is sufficient to induce In diffusion in regions of lower Si concentration. Zinc diffusion is found to completely intermix the Ga and Al in the heterolayers at temperatures as low as 825 K, which is below the temperature at which significant In diffusion occurs in undoped regions.

4773 **Mix of molecular adsorption sites detected for disordered CO on Pt(111) by diffuse low-energy electron diffraction.** Blackman, G.S.; Xu, M.; Ogletree, D.F.; Van Hove, M.A.; Somorjai, G.A. (Center for Advanced Materials, Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **61**: No. 20, 2352-2355(14 Nov 1988).

Complete local-bonding geometries in a disordered molecular overlayer have been determined, together with the relative occupation of different coexisting adsorption sites. Diffuse LEED intensities were measured with a new, highly sensitive, and low-noise, digital-LEED detector, and calculated with an extension of the efficient beam-set-neglect theory. At one-third of a monolayer of carbon monoxide on Pt(111) at 160 K, (88 +- 5)% of the molecules are found to occupy top sites and (12 +- 5)% bridge sites, with bond lengths consistent with earlier results for ordered layers.

4774 **Fluorination of amorphous thin-film materials with xenon fluoride.** Weil, R.B. (to Dept. of Energy). US Patent Application 6-045,920. 1 May 1987. 13p. Contract AC02-83CH10093. DE89000211 NTIS, PC A03/MF A01. Order Number DE89000211/JAW.

A method is disclosed for producing fluorine-containing amorphous semiconductor material, preferably comprising amorphous silicon. The method includes depositing amorphous thin-film material onto a substrate while introducing xenon fluoride during the film deposition process.

4775 **Intrinsic gettering of iron in silicon: A quantitative study.** Colas, E.G.; Weber, E.R.; Hahn, S. (Dept. of Materials Science and Mineral Engineering, Univ. of California, Berkeley, CA (US)). pp 13-20 of Materials issues in silicon integrated circuit processing. Wittmer, M.; Stimmell, J.; Strathman, M. Pittsburgh, PA; Materials Research Society (1986). (CONF-860445—).

From Materials Research Society spring meeting; Palo Alto, CA, USA (15 Apr 1986).

Intrinsic gettering of iron in silicon has been studied with a novel approach that involved the combination of two complementary techniques. Electron Paramgentic Resonance (EPR) was used to determine the concentration of interstitial iron atoms which are electrically active in the silicon matrix. A systematic comparison of the effect of various oxygen precipitates of well defined morphologies on the solubility of iron was performed. A surprising result was found for bulk samples containing oxygen precipitates obtained after low temperature heat treatments (700°C); the solubility of iron was reduced by almost two orders of magnitude from the values obtained in untreated Cz silicon samples or in samples containing oxygen precipitates obtained at high temperature (1150°C). The practical importance of this new result was demonstrated by a series of iron concentration measurements after various gettering and high temperature re-heating treatments. Transmission Electron Microscopy (TEM) was used in order to confirm the proposed mechanism of formation of a new phase, different from FeSi/sub 2/ in the silicon matrix. This new phase is assumed to limit the possible electrically active metallic content by acting as a boundary phase in quasi-equilibrium with interstitial iron atoms. Evidence of the formation of Fe/sub 2/SiO/sub 4/ was found in wafer that had been oxygen implanted and subsequently subjected to similar precipitation and diffusion treatments than those performed with the bulk samples. These findings suggest the possibility of dramatic improvements in the efficiency and the stability of the gettering process.

4776 **Trapping of interstitials during ion implantation in silicon.** Culbertson, R.J.; Pennycook, S.J. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 357-362 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The solid phase epitaxial regrowth of silicon implanted with a group V dopant, such as antimony, results in excellent incorporation of the dopant atoms into silicon lattice sites. However, annealing at higher temperatures or longer times results in transient dopant precipitation with a diffusion coefficient up to five orders of magnitude above that of tracer diffusion and with a reduced activation energy. This precipitation is accompanied by the nucleation of dislocation loops that are interstitial in nature, and the transient ceases as the dislocation loops develop. It is believed that Si interstitials are trapped in a stable effect complex during the implantation process. Although they survive SPE these complexes dissolve at higher temperatures and release a large supply of interstitials which serve to promote dopant migration via an interstitialcy mechanism until they condense to form the observed dislocation loops. By following the Sb implantation with an implantation of B to an equivalent concentration profile the loop formation is efficiently suppressed. For higher B concentrations the Sb precipitation is no longer observed. Results for As implantation are similar to Sb except that As precipitates cannot be directly observed. Calculations of the dopant and interstitial concentration depth distributions were also performed.

4777 **Amorphization and recrystallization processes in monocrystaline beta silicon carbide thin films.** Edmond, J.A.; Withrow, S.P.; Kong, H.S.; Davis, R.F. (Dept. of Materials Engineering, North Carolina State Univ., Raleigh, NC (US)). pp 395-404 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Individual, as well as multiple doses of /sup 27/Al/sup +/, /sup 31/P/sup +/, /sup 28/Si/sup +/ and /sup 28/Si/sup +/ plus /sup 12/C/sup +/ were implanted into (100) oriented monocrystaline β-SiC films. A critical energy of $\simeq$ 16 eV/atom required for the amorphization of β-SiC via implantation of Al and P was determined using the TRIM84 computer program for calculation of damage-energy profiles coupled with results of RBS/ion channeling analyses. In order to recrystallize amorphized layers created by the individual implantation of all four ion species, thermal annealing at 1600, 1700, or 1800°C was employed. Characterization of the recrystallized layers was performed using XTEM. Examples of SPE regrown layers containing; 1) precipitates and dislocation loops, 2) highly faulted, microtwinned regions, and 3) random crystallites were observed.

4778 **Ion beam deposition of materials at 40-200 eV: Effect of ion energy and substrate temperature on interface, thin film and damage formation.** Herbots, N.; Appleton, B.R.; Pennycook, S.J.; Noggle, T.S.; Zuhr, R.A. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 369-374 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Ion beam deposition (IBD), the process whereby magnetically analyzed ions are directly deposited on single crystal substrates, has been studied for /sup 74/Ge and /sup 30/Si ions on Si(100) and Ge(100). The effects of sputter-cleaning prior to deposition and substrate temperature during deposition were investigated. Three analytical techniques were systematically used to obtain information on the deposited films: (1) Rutherford backscattering combined with ion channeling, (2) cross-section TEM, and (3) Seeman-Bohliln X-ray diffraction. In the energy range explored (40 - 200 eV), the width of the interface between the IBD film and the substrate was found to be always less than 1 nm. Each IBD layer was highly uniform in thickness and composition for deposition temperatures from 300 K to 900 K. Without prior sputter-cleaning and annealing of the Si(100) and Ge(100) substrates, no epitaxy was observed. UHV conditions were found to be a requirement in order to grow crystalline Si films presenting bulk-like density. This was not the case for Ge films which showed bulk-like density for IBD at higher pressures. Results on the first Si/Ge superstructure grown by IBD are also shown.

4779 **The crystalline-to-amorphous phase transition in irradiated silicon.** Seidman, D.N.; Averback, R.S.; Okamoto, P.R.; Baily, A.C. (Northwestern Univ., Materials Science Dept., Evanston, IL (US)). pp 349-356 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The amorphous (a)-to-crystalline (c) phase transition has been studied in electron (e/sup -/) and/or ion irradiated silicon (Si). The irradiations were performed in situ in the Argonne High Voltage Microscope-Tandem Facility. The irradiation of Si, at $<$ 10 K, with 1-MeV e/sup -/ to a fluence of 14 dpa failed to induce the c-to-a transition. Whereas an irradiation, at $<$ 10 K, with 1.0 or 1.5-MeV Kr/sup +/ ions induced the c-to-a transition by a fluence of $\simeq$0.37 dpa. Alternatively a dual irradiation, at 10 K, with 1.0-MeV e/sup -/ and 1.0 or 1.5-MeV Kr/sup +/ to a Kr/sup +/ fluence of 1.5 dpa - where the ratio of the displacement rates for e/sup -/ to ions was $\simeq$0.5 - resulted in the Si specimen retaining a degree of crystallinity. These results are discussed in terms of the degree of

dispersion of point defects in the primary state of radiation damage and the mobilities of point defects.

4780 **Transition between condensed phases in Si and Ge.** Turnbull, D. (Center for Materials Science, Los Alamos National Lab., Los Alamos, NM (US)). pp 71-82 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The thermodynamic interrelation between the amorphous semiconducting (a-sc), the diamond cubic (c-sc) and the liquid metal (lm) states of Ge and Si is reviewed with especial emphasis on the question of the thermodynamic uniqueness of the a-sc state following its structural relaxation. The experience on the occurrence of the direct iotam → a-sc transition and its reverse is surveyed and interpreted. This experience, in conjunction with the lm undercooling studies of Devaud and the author, indicates that the formation, in the metastable regime, of a-sc from iotam results from preferential growth rather than preferential nucleation.

4781 **Anomalous behavior during the solidification of silicon in the presence of impurities.** Thompson, M.O.; Peercy, P.S. (Dept. of Materials Science, Cornell Univ., Ithaca, NY (US)). pp 99-112 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Nanosecond pulsed laser irradiation of silicon results in the melting of the surface with subsequent solidification from a crystalline substrate. In the presence of impurities or alloys, the solidification dynamics are greatly affected by the nature of the impurities. Five classes of materials have been investigated: amorphous Si, mutually soluble alloys, high solubility impurities, low solubility impurities, and compound forming materials. Solidifications of each of these classes of materials is discussed. Several anomalous kinetic regimes are observed, including explosive crystallization, surface nucleation of solid, and internal nucleation of melt. These results are interpreted in terms of thermodynamic modifications of the melting temperature in the alloy regions.

4782 **Direct imaging of "explosively" propagating buried molten layers in amorphous silicon using optical, TEM and ion backscattering measurements.** Lowndes, D.H.; Jellison, G.E. Jr.; Pennycook, S.J.; Withow, S.P.; Mashburn, D.N.; Wood, R.F. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 131-136 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The behavior of pulsed laser-induced "explosively" propagating buried molten layers (BL) in ion implantation-amorphized silicon has been studied in a time- and spatially-resolved way, using nanosecond time-resolved reflectivity measurements, "Z-contrast" scanning transmission electron microscope (STEM) imaging of implanted Cu ions transported by the BL, and helium ion backscattering measurements. Infrared (1152 nm) reflectivity measurements allow the initial formation and subsequent motion of the BL to be followed continuously in time. The BL velocity is found to be a function of both its depth below the surface and of the incident KrF laser energy density (E/sub iota/); a maximum velocity of about 14 m/s is observed, implying an undercooling-velocity relationship of about 14 K/(m/s). Z-contrast STEM measurements show that the final BL thickness is less than 15 nm. Time-resolved optical, TEM and ion backscattering measurements of the final BL depth, as a function of E/sub iota/, are also found to be in excellent agreement with one another.

4783 **Transient conductance measurements and heat-flow analysis of pulsed-laser-induced melting of aluminum thin films.** Tsao, J.Y.; Picraux, S.T.; Peercy, P.S.; Thompson, M.O. (Sandia National Labs., Albuquerque, NM (US)). pp 283-288 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The authors report time-resolved electrical-resistance measurements during pulsed-laser melting of a metal, aluminum. The resistances are correlated with the thresholds for partial and full melting. They describe a semi-analytic solution, based on an impulse-response function, for the response, to a heating pulse, of a thin film of good thermal conductor supported by an infinite substrate. The results agree well with the resistance measurements, and confirm our interpretation of the data. In addition, time-resolved reflectance measurements establish that, in this geometry, melting and solidification proceed via the motion of a well-defined, planar liquid/solid interface, whose position can be deduced from the resistance measurements. These measurements permit the first real-time determinations of melt-depths and quenching histories during rapid-solidification processing of metals.

4784 **Time-resolved picosecond optical study of laser-excited graphite.** Huang, C.Y.; Malvezzi, A.M.; Liu, J.M.; Bloembergen, N. (Los Alamos National Lab., Los Alamos, NM (US)). pp 245-250 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The pump-and-probe technique is employed to perform picosecond time-resolved measurements of the reflectivity changes in highly oriented pyrolitic graphite excited by 0.532-μm pump pulses. At low pump fluences, the presence of a short-lived plasma and a high-temperature gradient gives rise to an increase in the reflectivity probed at 1.9 μm but causes a decrease at 1.064 μm. At the threshold fluence, 140 mJ/cm/sup 2/, the reflectivity drops abruptly, marking a phase transformation. Above the threshold, the reflectivity drops to —0.2 from its original value of 0.42 at 1.064 μm and to —0.4 from its ambient value of 0.50 at 1.9 μm. This new phase persists only for a few nanoseconds.

4785 **Overheating in silicon during pulsed-laser irradiation.** Larson, B.C.; Tischler, J.Z.; Mills, D.M. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 113-118 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Nanosecond resolution time-resolved x-ray diffraction measurements of thermal strain have been used to measure the interface temperatures in silicon during pulsed-laser irradiation. The pulsed-time-structure of the Cornell High Energy Synchrotron Source (CHESS) was used to measure the temperature of the liquid-solid interface of <111> silicon during melting with an interface velocity of 11 m/s, at a time of near zero velocity, and at a regrowth velocity of 6 m/s. The results of these measurements indicate 110 K difference between the temperature of the interface during melting and regrowth, and the measurement at zero velocity shows that most of the difference is associated with undercooling during the regrowth phase.

4786 **Nucleation of internal melt during pulsed laser irradiation.** Peercy, P.S.; Thompson, M.O.; Tsao, J.Y.; Poate, J.M. (Sandia National Labs., Albuquerque, NM (US)). pp 125-130 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Real-time measurements of the molten layer thickness and simultaneous measurements of the melt duration at the surface reveal

that melt nucleates internally when Si implanted with low solid-solubility impurities such as In is melted with a 30 nsec laser pulse at 694 nm. Internal nucleation of melt was observed for all energy densities examined. Furthermore, at energy densities insufficient to melt the entire amorphous layer, internal nucleation of melt is followed by an explosive-like process in which a buried molten layer propagates toward the irradiated surface.

4787 **Time-resolved reflectivity measurements of silicon and germanium using a pulsed excimer laser.** Jellison, G.E. Jr.; Lowndes, D.H.; Mashburn, D.N.; Wood, R.F. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)). pp 143-148 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Time-resolved reflectivity measurements of silicon and germanium have been made during pulsed KrF excimer laser irradiation. The reflectivity was measured simultaneously at both 1152 and 632.8 nm wavelengths, and the energy density of each laser pulse was monitored. The melt duration and the time of the onset of melting were measured and compared with the results of melting model calculations. For energy densities just above the melting threshold, it was found that the melt duration was never less than 20 ns for Si and 25 ns for Ge, while the maximum reflectivity increased from the value of the hot solid to that of the liquid over a finite energy range. These results, along with a reinterpretation of earlier time-resolved ellipsometry measurements, indicate that, during the melt-in process, the near-surface region does not melt homogeneously, but rather consists of a mixture of solid and liquid phases. The reflectivity at the onset of melting and in the liquid phase have been measured at both 632.8 and 1152 nm, and are compared with the results found in the literature.

4788 **Pulsed CO/sub 2/-laser induced melting and nonlinear optical studies of GaAs.** James, R.R.; Christie, W.H.; Mills, B.E.; Burcham, H.L. Jr. (Sandia National Labs., Livermore, CA (US)). pp 161-166 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The authors report new optical and structural properties of p-type GaAs that result from the absorption of high-intensity 10.6 μm radiation. Prior to the onset of surface melting, the authors find that the absorption coefficient decreases with increasing intensity in a manner predicted by an inhomogeneously broadened two-level model. As the energy density of the CO/sub 2/ laser radiation is increased further, the surface topography shows signs of melting, formation of ripple patterns, and vaporization. Auger spectroscopy and electron-induced x-ray emission show that there is loss of As, compared to Ga, caused by the melting of the surface. Using plain-view TEM they find that Ga-rich islands are formed near the surface during the rapid solidification of the molten layer. Auger and SIMS measurements are used to study the incorporation of oxygen in the near-surface region, and the results show that oxygen incorporation can occur for GaAs samples that have been irradiated in air.

4789 **Raman studies of phase transformations in pulse laser irradiated dielectric films.** Exarhos, G.J. (Pacific Northwest Lab., P.O. Box 999, Richland, WA (US)). pp 179-184 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

Sputter deposited TiO/sub 2/ and ZrO/sub 2/ films on silica have been characterized with regard to thickness, phase purity, and residual film stress using nondestructive Raman spectroscopic techniques. Irradiated anatase coatings exhibit vibrational features that irreversibly shift to higher frequencies, suggesting an increase in localized stress. Catastrophic damage is manifested by the appearance of a higher density rutile phase. Rutile coatings examined after irradiation show only intensity changes, while amorphous coatings were found to rapidly crystallize under high-pulse energy irradiation. Results of these studies are compared with equilibrium Raman measurements of thermally-induced transformation in these materials.

4790 **A relationship between interatomic bonding and electron transport in plasma-deposited, amorphous metal alloys.** Pike, G.E.; Hays, A.K.; Nelson, G.C.; Fritz, I.J. (Sandia National Labs., Albuquerque, NM (US)). pp 135-142 of Thin films: The relationship of structure to properties. Aita, C.R.; SreeHarsha, K.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Amorphous metal alloy films have been produced using a new technique. Nominally NiP alloys are made by dissociating mixtures of nickel carbonyl and phosphine using a radio-frequency discharge in either an argon or a hydrogen carrier gas. This process incorporates a significant amounts of carbon and oxygen impurities into the film. A previously unreported relationship between the interatomic bonding involving these impurities and the electronic transport properties of the films is discussed in this paper. The bonding studies were carried out principally using Auger lineshape analysis. Transport properties measured included 4-terminal resistivities, Hall mobilities and carrier concentrations, and Seebeck coefficient. Covalent bonding of Ni with C or P with O is strongly correlated with high resistivity, mainly through a decrease in carrier density.

4791 **Film stress in Pd/sub 2/Si layers of varying thickness.** Coulman, B.; Chen, H.; Ritz, K. (Univ. of Illinois at Urbana-Champaign, IL (US)). pp 155-160 of Thin films: The relationship of structure to properties. Aita, C.R.; SreeHarsha, K.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Little is known about the development of film stresses in very thin films (thicknesses of the order of a few hundred Angstroms or less). As interest intensifies in the technological application of ever smaller quantities of materials, the behavior or very thin films will undergo increasing scrutiny. In this study, the film stresses in evaporated Pd films and Pd/sub 2/Si films formed by reaction with the Si substrates at 250°C were measured for thicknesses ranging from 7 to 107 nm. Stresses were calculated from the substrate radii of curvature determined by X-ray diffraction topography techniques (Lang and double crystal) and Stoney's equation. Because film continuity cannot be taken for granted at low coverage, the films were examined by electron microscopy in an attempt to correlate their morphology with the observed stresses.

4792 **Capillary instabilities in thin, polycrystalline films.** Srolovitz, D.J.; Safran, S.A. (Los Alamos National Lab., Los Alamos, NM (US)). pp 53-60 of Thin films: The relationship of structure to properties. Aita, C.R.; SreeHarsha, K.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

Thin films can break up into islands only if they are perturbed by substrate-intersecting perturbations. Grain boundary grooves and vertex pits are typical defects with nucleate holes in these films. Holes which exceed a critical size - proportional to the ratio of the film thickness to the equilibrium contact angle - grow, eventually disconnecting the film.

4793 **Ion-beam deposition of thin films: Influence on surface and volume microstructure.** Al-Jumailly, G.A.; McNally, J.J.; McNeil, J.R. (Dept. of Electrical and Computer Engineering, Univ. of New Mexico, Albuquerque, NM (US)). pp 85-92 of Thin films: The relationship of structure to properties. Aita, C.R.; SreeHarsha, K.S. Pittsburgh, PA; Materials Research Society (1985). (CONF-850421—).

From 2. spring meeting of the Materials Research Society; San Francisco, CA, USA (15 Apr 1985).

The effects of ion bombardment during film deposition on surface and volume microstructure were studied. Both metal and dielectric films were investigated. Scattered light and optical constants were examined for evaporated, sputtered and ion assisted films.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 4182, 4236, 4238, 4239, 4776, 4778, 4791, 5026, 5027, 5045, 5142, 5144, 5146, 5241, 5315, 5600

4794 **(AD-A—196970/8/XAB) Identification of mustard-related compounds in aqueous samples by gas chromatography-mass spectrometry.** D'Agostino, P.A.; Provost, L.R.; Hansen, A.S.; Luoma, G.A. (Defence Research Establishment Suffield, Ralston, Alberta (Canada)). May 1988. 59p. (DRES-SR—488). NTIS, PC A04/MF A01.

Thiodiglycol and a number of other compounds were detected during gas-chromatographic analysis of aqueous samples obtained from near the site of the former DRES mustard hydrolysate vaults. Hexane extracts of the aqueous samples were analysed by capillary column gas chromatography-mass spectrometry (GC-MS) under both electron-impact and chemical ionization conditions. Interpretation of the MS and complementary capillary column GC - Fourier-transform infrared data led to the characterization and identification of many compounds, including ether/thioether macrocycles and vinyl alcohol compounds, not previously associated with mustard decomposition.

4795 **(CEA-R—5456) Contribution to the application of nuclear microprobe in geochemistry. Carbon and nitrogen microanalysis in glasses and minerals.** Mosbah, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 210p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755995/JAW.

The morphological complexity of geological materials implies the use of microanalysis techniques utilization. Nuclear microprobe allows selective and no destructive light elements determination, through nuclear reactions. Nuclear microanalysis has been used to characterize carbon and nitrogen in volatile phase dissolved in magmatic samples. The application of some microanalysis techniques in geochemistry are discussed, nuclear microprobe theory and techniques are developed. Minerals, glasses and glassy inclusions are described, and more particularly, the interest of these investigations. Optimal conditions of carbon and nitrogen analysis (/sup 12/C(d.p)/sup 13/C and /sup 14/N(d,p)/sup 15/N reaction respectively), as deuteron energy and observation angle are studied. A methodology has been established for this purpose. Several results are exposed: Punctual analysis, carbon concentration profile in depth surface scanning, surficial mapping in glassy inclusions. The carbon content interpretation in glassy inclusions measured conveniently for the first time agrees with data obtained through other techniques. In conclusion, degazing schedule improvements require more analysis. Perspective research axis are evocated.

4796 **(CEA-R—5460) Determination of plutoniumn and transplutonium elements in the environment.** Willemot, J.M.; Verry, M.; Jeanmaire, L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Inst. de Protection et de Surete Nucleaire). 1988. 14p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755997/JAW.

Environmental samples made of many different stable elements and natural emitting radionuclides must undergo chemical analysis allowing to prepare quality sources. Plutonium and americium sources with a good resolution can be obtained from environmental samples by successive operations of co-precipitation ion-exchange separation and solvent extraction. Spectral analysis is then simple and consequently plutonium and transplutonium elements are determined easily in such samples. 15 refs.

4797 **(CEA-tr—2241) Influence of zirconium ion concentration in model extraction systems TBP - diluents - Zr /sup +4/ - nitric acid.** Rogoz, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1987. 25p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755335/JAW.

Stability of emulsions is slightly increased by zirconium ions in systems containing TBP only. Addition of MBP gives precipitates stabilizing the emulsion increasing the difficulty of separation. Addition of DBP increases the stability of emulsions more than MBP, especially for high concentrations of zirconium and low concentration of nitric acid. In both cases kerosene gives emulsions more stable than carbon tetrachloride.

4798 **(CEA-tr—2242) Influence of zirconium ion concentration in model extraction systems TBP - diluents - Zr/sup +4/ - nitric acid.** Rogoz, F.; Tlalka, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1987. 21p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755336/JAW.

In systems containing TBP, MBP, DBP and 1-butanol stable emulsions and precipitates are formed which separation is difficult in certain domain of concentration in zirconium ions. MPB and DBP increase stability of primary emulsion in kerosen and carbon tetrachloride but for different concentrations of nitric acid. Addition of 1-butanol decreases slightly the stability of primary emulsion.

4799 **(GSI—88-48-Prepr.) Radiochemical separations of target-like reaction products from Au-, Pt-, and Th-targets after irradiation with GeV protons.** Szweryn, B.; Bruechle, W.; Schausten, B.; Schaedel, M. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755401/JAW.

Chemical separation procedures for separations of reaction products after spallation reactions with 2.6 GeV protons and heavy element targets are presented. To determine independent cross sections of individual isotopes the elements Au, Pt, Ir, Os, Re, W, Ta, Hf, (Lu, Yb, Tm, Er), (Gd, Eu, Sm), were separated from gold targets, Pt, Ir, Os, W, Ta, Hf, (Lu, Yb, Tm, Er), (Gd, Eu, Sm) from a platinum target and Au, Tl from a thorium target.

4800 (INIS-mf—11323, pp 3) **Activation analytical determination of technetium.** Goerner, W.; Spies, H.; Noll, B.; Thieme, K. May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4801 (INIS-mf—11324, pp 26-27) **Standardization methods in reactor-neutron activation analysis.** Simonits, A.; De Corte, F. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics; Ghent Rijksuniversiteit (Belgium). Inst. voor Kernwetenschappen). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4802 (INIS-mf—11324, pp 28-29) **NAA: A unique tool for reference material certification.** Becker, D.A. (National Bureau of Standards, Gaithersburg, MD (USA)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4803 (INIS-mf—11324, pp 30-31) **Elemental analysis of coal based on spectroscopy of prompt gamma-rays from neutron induced reactions.** Pospisil, S.; Janout, Z.; Konicek, J.; Vobecky, M. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska; Ceskoslovenska Akademie Ved, Prague. Ustav Nuklearni Biologie a Radiochemie). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4804 (INIS-mf—11324, pp 78) **Determination of major elements in limestones by wavelength dispersive XRF.** Pelikanova, M. (Geologicky Pruzkum, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4805 (INIS-mf—11324, pp 79) **Analysis of bronze hoards from Horovicky, Rakovnik district, Czechoslovakia.** Hodik, F.; Pavlik, L.; Slabina, M. (Ceskoslovenska Akademie Ved, Prague. Ustav Nuklearni Biologie a Radiochemie; Narodni Muzeum, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4806 (INIS-mf—11324, pp 116) **RNAA of multielement reference materials by the k/sub 0/-standardization method. Comparison with other techniques.** Carmo Freitas, M. (LNETI/ICEN, Sacavem (Portugal)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4807 (INIS-mf—11324, pp 117) **Some experiences with installing the k/sub 0/-method of neutron activation analysis at the Institute "Josef Stefan", Ljubljana, Yugoslavia.** Jovanovic, S.; Vukotic, P.; Smodis, B.; Jacimovic, R.; Stegnar, P. (Titograd Univ. (Yugoslavia). Institute for Mathematics and Physics; Institut Jozef Stefan, Ljubljana (Yugoslavia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4808 (INIS-mf—11324, pp 118) **User-oriented tabulation of true-coincidence correction factors.** De Corte, F.; De Wispelaere, A. (Ghent Rijksuniversiteit (Belgium). Inst. voor Kernwetenschappen). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4809 (INIS-mf—11324, pp 119) **New developments in instrumental radioanalytical techniques.** Papadopoulos, N.N. (National Research Centre for the Physical Sciences Democritos, Athens (Greece)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4810 (INIS-mf—11324, pp 120) **Analysis of optoelectronics materials.** Stverak, B.; Kopejtko, J.; Tluchor, D.; Janu, M.; Blazek, K. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia); Monokrystaly, Turnov (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4811 (INIS-mf—11324, pp 121) **Instrumental neutron activation analysis of the old paintings.** Tluchor, D.; Stverak, B. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4812 (INIS-mf—11324, pp 122) **Purity following of new semiconductor materials.** Jiranek, V.; Janu, M.; Tluchor, D. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4813 (INIS-mf—11324, pp 123) **Instrumental neutron activation analysis of geological reference materials.** Kucera, J.; Soukal, L. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4814 (INIS-mf—11324, pp 124) **Could the limestones be a parent material for the karstic bauxites formation?.** Vukotic, P.; Jovanovic, S.; Dragovic, D. (Titograd Univ. (Yugoslavia). Institute for Mathematics and Physics; Titograd Univ. (Yugoslavia). Institute for Technical Research). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4815 (INIS-mf—11324, pp 138) **Corrosion of St. Vitus cathedral medieval mosaic by polluted environment.** Jurek, K.; Hybler, J.; Chab, V.; Zemek, J.; Bastl, Z.; Rohacek, K.; Hulinsky, V.; Perina, V. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav; Ceskoslovenska Akademie Ved, Prague. Ustav Fyzikalni Chemie a Elektrochemie J. Heyrovskeho; Ceskoslovenska Akademie Ved, Prague. Ustav Fyzikalni Chemie; State Institute for Restoration, Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4816 (INIS-mf—11324, pp 140) **Energy dispersive X-ray fluorescence analysis of fall-out of dust.** Balgava, V.; Kern, M. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4817 (INIS-mf—11324, pp 141-142) **Determination of sulphur on Whatman filters by the method of wavelength-dispersive X-ray fluorescence.** Spitzer, Z.; Kobr, M.; Santroch, J.; Vymola, R. (Ustav pro Vyzkum a Vyuziti Paliv, Bechovice (Czechoslovakia); Czech Hydrometeorological Institute, Prague (Czechoslovakia); Ceskoslovensky Uranovy Prumysl, Straz pod Ralskem. Ustredni Laboratore). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4818 (INIS-mf—11324, pp 144) **Determination of ash yield in coal by natural gamma-ray spectrometry.** Kalita, S.; Chrusciel, E.; Niewodniczanski, J. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4819 (INIS-mf—11324, pp 146) **Quality assurance in neutron activation analysis of environmental samples.** Obrusnik, I.; Kolar, L.; Faltejsek, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4820 (INIS-mf—11324, pp 147) **Study of leaching conditions of some heavy metals of soils by AAS and INAA.** Spevackova, V.; Kucera, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia). Fakulta Jaderna a Fysikalne Inzenyrska; Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4821 (INIS-mf—11324, pp 148) **Determination of alkali metals and radiocaesium in mushrooms.** Randa, Z.; Benada, J.; Horyna, J. (Ustav Nerostnych Surovin, Kutna Hora (Czechoslovakia); Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4822 (INIS-mf—11324, pp 149) **Instrumental neutron activation analysis of rare-earth and other trace elements in soils.** Caramella Crespi, V.; Genova, N.; Berzero, A.; Oddone, M.; Meloni, S. (Pavia Univ. (Italy)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4823 (INIS-mf—11324, pp 150) **Elemental characterization of the IAEA intercomparison samples of milk powder by neutron activation analysis.** Kucera, J.; Faltejsek, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4824 (INIS-mf—11324, pp 16-17) **Advances in applications of energy-dispersive X-ray fluorescence method for trace element analysis.** Holynska, B. (Institute of Physics and Nuclear Techniques, Krakow (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4825 (INIS-mf—11324, pp 75) **Comparison of the OES and XRF methods for the determination of minor elements in steels.** Zielina, S.; Kubon, Z.; Helan, V. (Trinecke Zelezarny (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4826 (INIS-mf—11324, pp 77) **X-ray fluorescent spectrometer application for the investigation of motor-car parts.** Wrona, J. (Politechnika Lubelska (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4827 (INIS-mf—11324, pp 125) **Determinatio of microgram amounts of Am by the gamma-spectrometric method of isotope dilution.** Sus, F.; Deron, S.; Raab, W. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia); Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4828 (INIS-mf—11324, pp 139) **Determination of heavy metals in food products.** Popko, R. (Politechnika Lubelska (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4829 (INIS-mf—11324, pp 143) **Determination of Ca and Sr in bones by XRF analysis.** Kliment, K. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

4830 (INIS-SU—58, pp 12-15) **Introduction of weighting factors when deriving calibration equations in X-ray fluorescence analysis.** Lavrent'ev, Yu.D.; Rogozhin, V.F.; Svetajlo, Yu.N.; Shchekin, K.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Method for improving accuracy of X-ray fluorescence analysis, based on introduction of weighting factors when deriving regression calibration equations is described. It is shown that the values of weighting factors can be chosen empirically; the most sufficient improvement of analysis accuracy is observed at that at low contents of determined elements. Example of using weighting factors for analysis of polymetallic and niobium-tantalum ores and products of their treatment is given. Introduction of weighting factors is realized in the software of multi-element X-ray fluorescence analyzer with semiconductor detector. 7 refs.; 1 fig.

4831 (INIS-SU—58, pp 15-17) **Improvement in accuracy of X-ray fluorescence analysis taking into account regularization parameter when deriving calibration equations.** Svetajlo, Yu.N.; Shchekin, K.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Sources of sufficient errors, which occur during mathematical processing of results of X-ray fluorescence analysis are analyzed. It is shown that construction of regression calibration equations when conducting multi-element X-ray fluorescence analysis can be complicated by correlated character of measured counting rates and low capacity of applied computing equipment (microprocessors and microcomputers). It is suggested to take into account the regularization parameter when solving the so-called incorrect problems; this will enable to improve the accuracy of analysis. Example of using regularization parameter for analysis of polymetallic ores is given. It is advisable to introduce the construction of calibration equations, taking into account the regularization parameter, into the software of multi-element X-ray fluorescence ana-

lyzer with semiconductor detector, based on microprocessor or microcomputer. 5 refs.; 1 fig.

4832 (INIS-SU—58, pp 18-19) **Automatic classification of samples in X-ray fluorescence analysis of complex composition samples.** Koloskov, S.A.; Svetajlo, Yu.N.; Shchekin, K.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Automatic classification of samples is suggested in order to provide the assigned accuracy of X-ray fluorescence analysis. The classification lies in the following: the whole body of analyzed samples is devided into assigned number of classes and regression equation is derived for each class. Each sample is refered automatically during analysis to its own class, and concentrations are calculated according to equations, corresponding to this class. Algorithm of sample classification is presented; examples of analysing complex lead-barite ore and products of its technological treatment is given. The suggested algorithm was realized in the software of automized multi-element analyzers with semiconductor detectors. The method can be widely used at the stage of search for minerals. 3 refs.

4833 (INIS-SU—58, pp 26-28) **Certain features of X-ray fluorescence analysis of rock powder samples using a radionuclide alpha source.** Kirillov, V.I.; Glasson, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Features of x-ray fluorescence analysis of light elements in sedimentary rocks using α-radiation source are considered. It is shown that material composition of the sample under investigation does not effect the measurement results. Effect of investigated sample granulometric composition inhomogeneity on the secondary radiation intensity is described. Powder sample preparation technique is proposed allowing one to remove the effect of granulometric composition action on x-ray fluorescence analysis results. 9 refs.

4834 (INIS-SU—58, pp 28-31) **On representativity of measured sample layer in X-ray fluorescence analysis of sulfide ores.** Kuzovnikov, V.N. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Applicability of x-ray fluorescence determination of element composition of copper sulfide ores at some deposits in the South Ural is considered. Calculations of effective atomic numbers for maximum element compositions in solid and disseminated ores as well as in country rocks are performed. Results of saturated layer thickness calculation for these conditions are presented and evaluation of representativity of sample layer under investigation when determining Fe, Cu, Zn, Pb and Ba is given. Recommendations concerning optimization of sulfide ore powder sample preparation conditions in the course of x-ray fluorescence determinations of ore elements are given. 7 refs.; 3 tabs.

4835 (INIS-SU—58, pp 55-57) **Study on the applicability of Geiger-Mueller neutron counter and /sup 238/Pu-/sup 7/Li source to determining neutron absorber concentration by neutron absorption method under different conditions of measurement geometry.** Goleva, V.I.; Shumakov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Possibility of applying SNM-54-type Geiger-Mueller neutron counter for determination of neutron absorber concentration (boron compounds, cadmium, gadolinium) in aqueous solutions by neutron-absorption technique is experimentally investigated. Three measurement geometries used in this case are considered: plane, ring and volumetric. It is shown that with ring and volumetric measurement geometries it is advisable to use SNM-54 counter because the method sensitivity practically does not change in this case and the recording equipment is sufficiently simplified. SNM-54 counter application in the case with plane measurement geometry is not advisable due to high γ-background. In case /sup 238/Pu-/sup 7/Li neutron source is replaced by /sup 239/Pu-/sup 9/Be one with the similar flux the method efficiency is increased about two times. 9 refs.; 3 figs.

4836 (INIS-SU—58, pp 20-22) **X-ray fluorescence analysis of zirconium pulps with dip sensors.** Evtushenko, A.V.; Yakovlev, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Consideration is given to X-ray fluorescence analyzer for analyzing pulps and solutions immediately in the flow and to results of its performance testing. The analyzer contains two dip sensors, the unit for analogue data processing and recording unit. The relative root-mean-square error of zirconium determination in 0.29-4.77 g/l range was equal to about 10% for 100 s measuring period. Zirconium distribution with the depth of analyzed volume and the effect of pulp particle size on analysis results were investigated. 3 refs.; 4 figs.

4837 (INIS-SU—58, pp 22-26) **Automatic analysis of process products during flotation of copper-zinc ores.** Perevezentsev, I.Yu.; Svetajlo, Yu.N.; Uzvolok, A.L.; Yakovlev, V.I. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Consideration is given to the design and software of X-ray fluorescence analyzer RAT-MP1, designated for simultaneous automatic determination of the content of up to five elements in solid phase of pulps using dip radioisotope sensors, based on semiconductor detectors, as well as to results of its performance testing. The average relative divergence of analysis results, obtained by X-ray fluorescence and chemical methods was equal to about 8% for determination of copper content in 0.68-1.63% range and about 7% for zinc content in 2.25-4.64% range. 3 figs.

4838 (KFK—4430) **Chemical state of AUPuC and OCOM mixed oxide at different stages of the nuclear fuel cycle.** Kleykamp, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Aug 1988. 58p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755588/JAW.

Advanced uranium-plutonium oxide fuels of high density that have been manufactured by the ammoniumuranylplutonylcarbonate (AUPuC) and optimized cogrinding (OCOM) processes in industrial scale for irradiations in fast breeder and light water reactors were examined. The uranium-plutonium homogeneity and the oxygen-to-metal distribution as well as the impurities in the fuel pellets were investigated by X-ray microanalysis and X-ray diffraction. The FBR fuels were first irradiated within the experiment series No. 7 of the FR2 reactor at high linear heat ratings about 50 kW/m up to 3.8% burnup. The problems of the fuel component redistributions (formation of U/Pu and O/M gradients), the fission product behaviour and the fuel-cladding compatibility are clarified within the post-irradiation studies. The uranium-to-plutonium redistribution is small due to the high fuel density and the low initial O/M ratio. There is a strong O/M redistribution yielding a second oxygen poor oxide phase at the central void. The fission product induced cladding attack is insignificant. The fuels of this irradiation experiment were dissolved in nitric acid. The rate of dissolution is excellent; the residues amount to 0.2% of the fuel after 1% burnup. The AUPuC oxide is superior to the OCOM oxide due to the lesser amount of the undissolved fuel in the residues. The main fractions of the residues are reprecipitated fission product oxide hydrates.

4839 (NEI-DK—106) **Nordic laboratory for thermoluminescence dating.** Mejdahl, V. (Risoe National Lab., Roskilde (Denmark)). May 1988. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755670/JAW.

Also published in Danish.

Thermoluminescence dating is based primarily on the minerals quartz and feldspar which are present in most sedimentary de-

posits and in many materials of archaeological interest, e.g. ceramics and tile. In nature the two minerals are affected by the radiation to which they are exposed from the omnipresent naturally occurring radioactive elements uranium, thorium and potassium. The radiation transfers energy to electrons which enables them to wander through the crystal. Some will be trapped at localities, called traps, where there are imperfections in the crystal, for example a missing negative ion. The number of trapped electrons is a measure of the radiation dose absorbed by the material. For minerals in Nature the number will also be related to the time elapsed since the traps were last emptied because one can assume that the intensity of the natural background radiation has been constant over the period relevant for TL dating, about one million years. The radiation dose accumulated in quartz and feldspar can be determined by heating the minerals to a temperature of about 500 deg. C. The heating will enable the trapped electrons to escape and return to their ground level. The energy liberated will be emitted as a blue/biolet light called thermoluminescence (abbreviated TL). The ligth signal from natural samples is compared with that emitted by samples which have been given a known dose of radiation in the laboratory. In this way the unknown dose absorbed by the minerals in Nature can be determined. Archeological materials datable by TL include ceramics, bricks and burnt clay from kilns and house walls, and burnt stones. Treatment of samples and dating procedure is described as is also the determination of background and beta radiation. TL dating can be applied over a time span ranging from the present to approximately 500.000 years, uncertainty varies from 50 to 200-300 years. (Abstract Truncated)

4840 **(RAL—88-072) Critical reflection activation analysis - a new near-surface probe.** Gunn, J.M.F.; Trohidou, K.N. (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756026/JAW.

We propose a new surface analytic technique, Critical Reflection Activation Analysis (CRAA). This technique allows accurate depth profiling of impurities ≦ 100A beneath a surface. The depth profile of the impurity is simply related to the induced activity as a function of the angle of reflection. We argue that the technique is practical and estimate its accuracy.

4841 **Optical analyzer.** Hansen, A.D. (to Dept. of Energy). US Patent Application 6-101,534. 28 Sep 1987. 14p. Contract AC03-76SF00098. DE89000199 NTIS, PC A03/MF A01. Order Number DE89000199/JAW.

An optical analyzer wherein a sample of particulate matter, and particularly of organic matter, which has been collected on a quartz fiber filter is placed in a combustion tube, and light from a light source is passed through the sample. The temperature of the sample is raised at a controlled rate and in a controlled atmosphere. The magnitude of the transmission of light through the sample is detected as the temperature is raised. A data processor, differentiator and a two pen recorder provide a chart of the optical transmission versus temperature and the rate of change of optical transmission versus temperature signatures (T and D) of the sample. These signatures provide information as to physical and chemical processes and a variety of quantitative and qualitative information about the sample. Additional information is obtained by repeating the run in different atmospheres and/or different rates or heating with other samples of the same particulate material collected on other filters. 7 figs.

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REFER ALSO TO CITATION(S) 4088, 4149, 4150, 4150, 4250, 4277, 4712, 4762, 4855, 5014, 5043, 5082, 5083, 5580, 5593, 5614

4842 (ACIESP—60-Vol.1, pp 12) **Chemical approach to high - Tc oxide superconductors.** Fueki, K. (Tokyo Univ. (Japan)). 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704411/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

4843 **(DOE/ER/10677—10) Diffusion flame studies of the chemical and physical mechanisms of soot formation from aromatic and substituted aromatic fuels: Progress report for period February 16, 1985--February 15, 1986.** Merklin, J.F.; Sorensen, C.M. (Kansas State Univ., Manhattan (USA)). Mar 1986. Contract AC02-80ER10677. 37p. NTIS, PC A03/MF A01. Order Number DE89003041/JAW.

Benzene was found to be the first product formed in the shock-tube pyrolysis of toluene in the temperature range from 1100 K to 1700 K. The yield of benzene peaked at 1425 K. The production of benzene, acetylene and methane was modeled by a set of nine chemical reactions using rate constants reported in the literature. Benzene was shock-heated in the temperature range from 1100 K to 1700 K and biphenyl, phenanthrene, pyrene and p-terphenyl were detected with the liner residue method. This is the first time these species have been observed in shock-tube pyrolysis. These results suggest that in the initial stages of soot formation phenyl rings and acetylenic fragments are required. From the chemical probing of a sooting pre-mixed methane oxygen, it is shown that the growth of soot particles from 10 to 20 nm, in a large part, is due to surface addition of acetylenic fragments. Premixed benzene{endash}doped methane/oxygen flames were optically probed to determine the soot volume fraction and the soot particle size. The maximum flame temperature and C/O were held constant. As the benzene concentration was increased, the soot volume fraction increased at early times in the flames. However, the ultimate soot volume fraction was unaffected by the substitution of benzene for methane. 19 refs., 12 figs., 4 tabs.

4844 **(DOE/ER/13327—3) Studies of metal ammonia interactions with aromatic substrates: Progress report, January 1, 1988--December 31, 1988.** Rabideau, P.W. (Indiana Univ.-Purdue Univ., Indianapolis (USA). Dept. of Chemistry). 1988. Contract FG02-85ER13327. 4p. NTIS, PC A02/MF A01. Order Number DE89003360/JAW.

Our chief accomplishment have dealt with fundamental research in the areas of metalammonia reduction of aromatics and polynuclear aromatics, and the conformational analysis of hydroaromatics. This work relates to coal science in that the compounds studied may serve as models for coal itself. The dissolving metal reduction of coal has attracted considerable attention since the initial reductive alkylation experiments by Sternberg demonstrated substantial solubility enhancements by this method. Several of the processes involved are related to our previous and current work. They are (1) reduction of aromatic rings, (2) incorporation of alkyl groups, (3) cleavage of certain carbon-carbon bonds, (4) cleavage of diaryl and aryl/alkyl ethers, and (5) alkylation of phenoxides. In addition, hydroaromatics (which are common products of metalammonia reduction) have received renewed attention since they serve an important role as hydrogen donors during coal gasification and liquefaction. This may be accomplished by the addition of hydroaromatics to the coal or by hydroaromatics units actually present in the coal structure itself.

4845 **(DOE/ER/13832—3) Metal ion complexation by ionizable crown ethers: Progress report, January 1988--August 1988.** Bartsch, R.A. (Texas Tech Univ., Lubbock (USA). Dept. of Chemistry and Biochemistry). Aug 1988. Contract FG05-88ER13832. 12p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003378/JAW.

Research conducted since the last progress report includes the synthesis and characterization of sixteen neutral and proton-ionizable crown ether compounds. Metal ion complexation behavior of new and previously-synthesized proton-ionizable crown ethers has been probed in solvent extraction, transport across bulk liquid membranes, and transport across polymer-supported liquid membranes. In addition, the thermodynamics of interactions between alkali metal cations and ionized crown ethers have been probed by calorimetry. 7 refs.

4846 (IES—8801, pp 81-82) **Solubility of nitrates (part 11). Phase equilibrium for the system of ammonium nitrate - Sodium chloride - water.** Akiyoshi, Miyako; Nawachi, Hisako; Hara, Yasutake; Nakamura, Hidetsugu. (Kyushu Inst. of Tech., Faculty of Engineering, kitakyushu, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Equilibrium diagrams of $NaCl-NaNO_3-H_2O$, $HN_4Cl-NaCl-H_2O$, and $NH_4NO_3-NaCl-H_2O$ were prepared to complete the equilibrium diagram of ammonium nitrate-sodium chloride -water system. For the measurement of concentration, electro-conductivity titration by NaOH was applied to ammonium ion, spectro-photometer (301nm) to nitrate ion, atomic absorption (330.23nm) to sodium ion, and H_2O was calculated as balance. Eutectic temperature was estimated by cooling-curve method. Solubility curves for the systems of $NaCl-NaNO_3-H_2O$ and $NH_4Cl-NaCl-H_2O$ were prepared for various temperature as shown by graphs. As the result, phase diagram for the system of $NH_4NO_3-NaCl-NaNO_3-NH_4Cl$ was completed as given as graph. (3 figs, 1 tab)

4847 (IES—8801, pp 91-92) **Estimation of heat of formation for high energy materials.** Hwn, Ton Ron; Tamura, Shozo; Yoshida, Tadao; Matsunaga, Takehiro; Tanaka, Noriaki; Hosoya, Fumio. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; National Chemical Lab. for Industry, Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Estimating method for enthalpy of formation was studied by applying MNDO and AMI to nitro-compounds, nitic acid esters, amines and nitrils. Calculation of molecular orbital method was conducted by applying MOPAC program and, as standard geometric stucture, CHEMOGRAM was cited. For the calculation of molecular orbital method, optimized structures were estimated by using the optimizing program included in MOPAC. By comparing the calculated result with experimental data, it was recognized that more accurate figures were obtained by applying optimized structure than by using standard structure. AMI method with optimized geometric structure gave the best result, except for the cases of nitric acid esters, alkyl amines without substituent, and aromatic amines, experimental corrections were neccessary. Correction equations were given for nitro compounds and amines. Among 47 compounds appeared on the table of calculated data, 37 gave deviation of less than 0.05 Kcal/gr from experimental data. (1 tab)

4848 (IES—8801, pp 95-96) **Thermal decomposition of aromatic nitro compound.** Ito, Aoi; Maekawa, Shoji; Matsunaga, Takehiro; Tamura, Shozo; Yoshida, Tadao; Ando, Takayuki; Morisaki, Shigeru. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Industrial Safety Inst., Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Effects of nitro group and substituent on thermal decomposition of aromatic nitro compounds were studied. For the experiment, nitro compounds of benzene and toluene were used. Measurements by DSC were conducted under nitrogen gas with 1-3 mg of sample, and by ARC under argon gas with 1 gr, respectively. It was considered that decomposition temperature were lowered and heat of reaction were increased with increased number of nitro group, substitution by electronic donor radical accelerated the decomposition and that considerably lower decmposition temperature was given by ARC measurement than that by DSC caused by the difference of measuring method. (4 figs)

4849 (LBL—25828) **Surface characterization of metal oxide overlayers.** Williams, K.J.; Levin, M.E.; Salmeron, M.; Bell, A.T.; Somorjai, G.A. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 14p. (CONF-880912—17). NTIS, PC A03/MF A01. Order Number DE89002667/JAW.

From 196. American Chemical Society national meeting; Los Angeles, CA, USA (25 Sep 1988).

The present paper discusses the characterization of titania overlayers deposited on the surface of a polycrystalline Rh foil and a Rh(111) surface. Submonolayer deposits of titania grow on the surface of Rh in the form of two-dimensional islands until a coverage of nearly a monolayer is achieved, at which point some three-dimensional growth of the islands is observed. The titania islands exclude CO chemisorption on Rh sites covered by the titania. The Ti^{4+} ions in the overlayer are readily reduced to Ti^{3+}. This process begins at the perimeter of the islands and extends inwards as reduction proceeds. Titania promotion of Rh enhances the rate of Co hydrogenation by up to a factor of three and increases the selectivity to C/sub 2+/ hydrocarbons. By contrast, the activity of Rh for the hydrogenolysis of ethane decreases monotonically with increasing titania promotion. 16 refs., 6 figs.

4850 (LBL—25859) **Fluids, both ionic and nonionic, over wide ranges of temperature and composition.** Pitzer, K.S. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 12p. (CONF-880810—1). NTIS, PC A03/MF A01. Order Number DE89001265/JAW.

From 10. conference on chemical thermodynamics; Prague, Czechoslovakia (29 Aug 1988).

After a brief historical review of the determination of standard state properties of hydrocarbons, the present status of nonideal gas and liquid state properties is considered. The accuracy to which various fluids follow the acentric factor system is examined. The shapes of vapor-liquid and liquid-liquid coexistence curves are considered with comparisons of theory and experiment for both short-range and long-range attractive forces. The effective critical exponent β/sub e/ is a sensitive measure of the shapes of these curves. Systems with short-range forces have low β/sub e/ throughout the entire range of temperature and never approach the high values of mean-field theories. Ionic systems show β/sub e/{congruent} 0.5 over wide ranges of temperature. The apparent conflict between the theoretical value 0.325 and a reasonable extrapolation of the experimental β/sub e/ to 0.35--0.36 for Ar and Xe at the critical temperature is discussed in relation to the model used in current theory and the desirability is expressed for a better model for the vapor-liquid system. An equation of state is described for $NaCl-H_2O$ which is valid at the critical point of H_2O and over the coexistence surface to 873 K. Equations are considered for mixed aqueous electrolytes of unlimited complexity valid for liquid-like densities. Recent results for Na_2SO_4 (aq) to 573 K are described, together with their use in predictions of solubilities in both $Na_2SO_4-H_2O$ and in $Na_2SO_4-NaCl-NaOH-H_2O$. 46 refs., 8 figs.

4851 (RISO-R—551) **On the stabilization of Nb/sup V/-solutions by Zr/sup IV/ and Hf/sup IV/.** Soerensen, E.; Bjerre, A.B. (Risoe National Lab., Roskilde (Denmark)). Nov 1987. 24p. NTIS (US Sales Only), PC A03/MF A01 - Risoe Library, DK-4000 Roskilde. Order Number DE88755680/JAW.

Niobium cannot be separated from zirconium or hafnium when these elements occur together in solution with common anions such as Cl- and SO/sub 4/--. This is ascribed to the copolymerisation of Nb/sup v/ and the hydrolyzed ionic species of Zr/sup IV/v and Hf/sup IV/ by which the colloidal particles are masked as Zr- and Hf-compounds. In HCl the particles are positively charged as opposed to when they are in sulphate solution where the Zr- and Hf- sulphate complexes confer a negative charge. The two cases are considered separately.

4005 Photochemistry

4852 (KFK-PEF—35-Vol.2, pp 615-625) **Photooxidation of biogenic hydrocarbons by ozone, NO/sub x/ and UV radiation.** Nolting, F.; Zetzsch, C. (Fraunhofer-Institut fuer Toxikologie und Aerosolforschung (ITA), Hannover (Germany, F.R.)). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

A smog chamber compartment for studies of the photodegradation of hydrocarbons in the presence of SO/sub 2/ was supplemented by aerosol equipment to observe gas-to-particle conversion with special impact on the formation of sulphur containing particles. Intensive measuring campaigns are performed in collaboration with the TU Berlin (Israel and Boehm) to study the formation of H/sub 2/SO/sub 4//sulphate aerosols. Calculations of the residence times of aerosols, confirmed in first experiments with model aerosols, demonstrate the suitability of the smog chamber to study aerosol forming photodegradation processes. In preparatory experiments on the reaction of SO/sub 2/ with ozone in the presence of humidity the formation of sulphuric acid was detected for the first time. First experiments under irradiation of a α-pinene/NO/sub x/-mixture in the presence of SO/sub 2/ showed no influence on ozone formation in comparison to studies without SO/sub 2/. The formation of sulphuric acid and of 'sulphate' is observed. A detailed characterisation of the conversion rates of SO/sub 2/ to these products, especially the identification of the 'sulphate' aerosol, is intended.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 4248, 5219

4853 (ACIESP—60-Vol.4, pp 1-12) **Pulse radiolysis on radical anions of sigma-conjugated polymers; organopolysilane and organopolygermane.** Ban, H.; Tanaka, A.; Hayashi, N.; Tagawa, S.; Tabata, Y. 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

Organopolysilane and organopolygermane solutions in tetrahydrofuran are investigated by pulse radiolysis. These σ-conjugated polymers become stable radical anions by an electron transfer reaction involving solvated electrons. The extra charge of the polymer radical anions is thought to be delocalized on the polymer skeleton.

4854 (ACIESP—60-Vol.4, pp 24-30) **Radiolysis of high temperature aqueous systems.** Ishigure, K.; Katsumura, Y.; Shiraishi, H. (Tokyo Univ. (Japan). Faculty of Engineering). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The results of the recent approaches which were made in laboratory to decide the primary G values of water radiolysis in the temperature range of 100 to 250/sup 0/C are presented. (E.G.).

4855 (HCR-CDM/LTM/DSO—4) **Study of TBP stability limits in pyrolysis, radiolysis and hydrolysis.** Azzouz, A.; Ahou, M.; Sfridi, L. (Commissariat aux Energies Nouvelles, Algiers (Algeria). Centre de Developpement de Materiaux). Oct 1985. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704329/JAW.

The present investigations deal with the determination of the stability limits of different degradation phenomena during TBP process achievement, its purification, storage or in radioelements extraction. The results were obtained using a simple and quick analysis method based on TBP:HC104 complex formation. The TBP is considered stable (when its degradation rate is less than 0,5% Vol.) for temperature less than 100/sup 0/C and time contact value of about 2 hours. It was depicted that TBP has an appreciable stability under the following conditions: NaOH 0,1 N/TBP=0,5 ml/ml and time contact <4 hours; POC13/TBP=0,02 ml/ml and time contact <1 hour; concentrated acid/TBP=0,025 ml/ml and time contact <1 h. Radiation cumulative effect seems to be the main precursor of TBP degradation. However, its stability remains appreciable under certain conditions. Practically, in all the cases, TBP decomposition is mainly tied to C-O bond breakdown.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 4799, 5211

4856 **(CEGB-TPRD/B—1064/R88) Decontamination of some urban surfaces.** Thornton, E.W. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Apr 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755475/JAW.

The long-term consequences of external radiation dose to the public could be a cause for concern in the event of a severe accident at a nuclear power plant leading to the release of fission products to the atmosphere and subsequent contamination of buildings, roads and other components of the urban environment. This study has concentrated on the decontamination of building materials contaminated under wet conditions with soluble, ionic radiocaesium. Results are given on the decontamination of building materials contaminated without run-off, on the effects of waiting between contamination and decontamination and on the effect of pre-treatment with an ammonium salt solution.

4857 **(FRNC-TH—3340) Preparation of radiopharmaceuticals labelled with bromine positron emitting isotopes for the study of dopaminergic receptors of the central nervous system using positron emission tomography.** Loc'h, C. (Conservatoire National des Arts et Metiers (CNAM), 75 - Paris (France)). Apr 1988. 162p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756020/JAW.

The in vivo study of dopaminergic receptors of the central nervous system using positron emission tomography requires the preparation of radiopharmaceuticals labelled with β/sup +/ emitting isotopes. The chemical and pharmacological properties of these ligands are evaluated. Cyclotron produced 75 and 76 bromine β/sup +/ emitting isotopes are incorporated into dopaminergic ligands by electrophilic substitution using peracetic acid in a no-carrier added form. Purity, lipophilicity and specific activity are analyzed. Pharmacological criteria (specificity, saturability, displacement, localization) required for ligand-receptor binding studies are evaluated in vitro on striatal membranes and in vivo in the rat. Positron emission tomographic studies show that the study of dopaminergic D2 receptors is possible using 75 and 76 bromine labelled bromospiperone and bromolisuride. These ligands are used in physiological and pharmacological studies of the central nervous system.

4858 (INIS-mf—11323, pp 1) **Tc(II)(NX) complexes (X = O, S): Contributions to the EPR spectroscopy and crystal analysis.** Kirmse, R.; Koehler, K.; Abram, U.; Lorenz, B.; Kaden, L.; Beurskens, P.T. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Chemie; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Katholieke Univ. Nijmegen (Netherlands)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4859 (INIS-mf—11323, pp 2) **EPR and multi-nucleus ENDOR investigations of tetrahalogenonitridotechnetate(VI) complexes TcNX/sub 4//sup -/ (X = Cl, Br).** Koehler, K.; Kirmse, R.; Boettcher, R.; Gribnau, M.C.M.; Abram, U. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Chemie; Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik; Katholieke Univ. Nijmegen (Netherlands); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4860 (INIS-mf—11323, pp 2) **Mass spectrometry of technetium complexes.** Stach, J.; Abram, U. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Chemie; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4861 (INIS-mf—11323, pp 3) **/sup 99/Tc-NMR - a method to characterize Tc complexes.** Findeisen, M.; Kaden, L.; Lorenz, B.; Wahren, M.; Abram, U. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4862 (INIS-mf—11323, pp 4) **CO conversion reaction at a heterogeneous /sup 99/Tc-Al/sub 2/O/sub 3/ catalyst.** Riedel, C.; Wahren, M. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4863 (INIS-mf—11323, pp 4) **Chemical preparation and characterization of novel technetium(I)-tricarbonylphosphine complexes.** Kaden, L.; Findeisen, M.; Lorenz, B.; Schmidt, K.; Wahren, M. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4864 (INIS-mf—11323, pp 5) **Chemical preparation and characterization of technetium-carbonyl complexes like Tc(CO)/sub 3/BrL/sub 2/ (L = phosphines, pyridines, isocyanates).** Lorenz, B.; Findeisen, M.; Olk, B.; Schmidt, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4865 (INIS-mf—11323, pp 5) **Technetium(I)-mixed-ligand complexes derived from Tc(N/sub 2/)H(DPPE)/sub 2/.** Abram, U.; Beyer, R.; Muenze, R.; Kaden, L.; Lorenz, B.; Findeisen, M. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4866 (INIS-mf—11323, pp 6) **Technetium complexes with a mixed phosphine-thiol coordination sphere.** Kampf, G.; Abram, U.; Beyer, R.; Abram, S.; Bergmann, R.; Maeding, P.; Muenze, R. May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4867 (INIS-mf—11323, pp 6) **Neutral, lipophilic TcO and TcN complexes and their behaviour against blood components and whole blood.** Beyer, R.; Abram, S.; Bergmann, R.; Lerch, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Medizinische Akademie, Dresden (German Democratic Republic)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4868 (INIS-mf—11323, pp 1) **Development of /sup 99m/Tc radiopharmaceuticals - an area of interdisciplinary research between chemistry and medicine.** Muenze, R. May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

4869 **(INIS-mf—11834) Development of a process for the removal of radioactively contaminated coatings from concrete and steel structures, when shutting down nuclear plant. Final report.** Klopfer, H.; Engelfried, R.; Ricken, D.; Schmidt, R. (Dortmund Univ. (Germany, F.R.); Geholit Lack- und Kunststoffchemie GmbH, Graben-Neudorf (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Feb 1986. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755576/JAW.

Considerable cooling (removal of heat) of materials leads to contractions and embrittlement. This permits a commutation of substances to be achieved. Through the application of very cold media on coated surfaces of concrete, screed, plaster and steel, such a considerable amount of heat is to be removed, that the arising inherent stresses lead to a separation of substrate in the coating. A carryout of radioactively contaminated components through arising primary and secondary waste must not occur here. Test specimens were produced with practical system structures, from substrate and coating. Using a specially constructed experimental plant, liquid nitrogen was applied to the coating surfaces. Under certain circumstances, it is possible to separate clods of coating from the substrate. Fine dusts or thaw water, which could cause a carryout of the radioactivity, were not observed. Application on an item, must be preceded by clarification of various influence, e.g. diffusion of stress in the compound system during nitrogen application, coating structure optimisation. (orig./HP) With 5 refs., 10 tabs., 25 figs.

4870 **Nonlinear optics and surface science.** Shen, Y.R. (Dept. of Physics, Univ. of California, Berkeley, CA (US)). pp 39-49 of Beam-solid interactions and phase transformations. Kurz, H.; Olson, G.L.; Poate, J.M. Pittsburgh, PA; Materials Research Society (1986). (CONF-8512143—).

From Beam-solid interactions and phase transformations; Boston, MA, USA (2 Dec 1985).

The recent status of applications of nonlinear optics to surface science is reviewed. The basic theory of wave mixing on a surface layer, and the possibility of using various nonlinear optical processes for surface probing are briefly discussed. Emphasis is on surface second harmonic generation, which is shown with many illustrations to be a rather unique and versatile tool for surface studies.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 4717, 4776, 4937, 5079, 5353

4871 (N—88-27254) Carbon deposition model for oxygen-hydrocarbon combustion, volume 1. Interim final report. Hernandez, R.; Ito, J.I.; Niiya, K.Y. (Aerojet Techsystems Co., Sacramento, CA (USA)). Sep 1987. 252p. (NASA-CR—179375; NAS—1.26:179375; REPT—2427-IFR-VOL-1; RPT/AA—0631-A/087-VOL-1). NTIS, PC A12/MF A01.

Presented are details of the design, fabrication, and testing of subscale hardware used in the evaluation of carbon deposition characteristics of liquid oxygen and three hydrocarbon fuels for both main chamber and preburner/gas generator operating conditions. In main chamber conditions, the deposition of carbon on the combustion chamber wall was investigated at mixture ratios of 2.0 to 4.0 and at pressures of 1000 to 1500 psia. No carbon deposition on the chamber walls was detected at these main chamber mixture ratios. In preburner/gas generator operating conditions, the deposition of carbon on the turbine simulator tubes was evaluated at mixture ratios of 0.20 to 0.60 and at chamber pressures of 720 to 1650 psia. The results of the tests showed carbon deposition rate to be a strong function of mixture ratio and a weak function of chamber pressure. Further analyses evaluated the operational consequences of carbon deposition on preburner/gas generator performance. The report is in two volumes, of which this is Volume 1 covering the main body of the report plus Appendixes A through D.

4872 (N—88-27255) Carbon deposition model for oxygen-hydrocarbon combustion, volume 2. Interim final report. Hernandez, R.; Ito, J.I.; Niiya, K.Y. (Aerojet Techsystems Co., Sacramento, CA (USA)). Sep 1987. 635p. (NASA-CR—179376; NAS—1.26:179376; REPT—2427-IFR-VOL-2; RPT/AA—0631/087-VOL-2). NTIS, PC A99/MF A01.

Presented are details of the design, fabrication, and testing of subscale hardware used in the evaluation of carbon deposition characteristics of liquid oxygen and three hydrocarbon fuels for both main chamber and preburner/gas generator operating conditions. In main chamber conditions, the deposition of carbon on the combustion chamber wall was investigated at mixture ratios of 2.0 to 4.0 and at chamber pressures of 1000 to 1500 psia. No carbon deposition on chamber walls was detected at these main chamber mixture ratios. In preburner/gas generator operating conditions, the deposition of carbon on the turbine simulator tubes was evaluated at mixture ratios of 0.20 to 0.60 and at chamber pressures of 720 to 1650 psia. The results of the tests showed carbon deposition rate to be a strong function of mixture ratio and a weak function of chamber pressure. Further analyses evaluated the operational concequences of carbon deposition on preburner/gas generator performance. This is Volume 2 of the report, which contains data plots of all the test programs.

42 ENGINEERING

REFER ALSO TO CITATION(S) 4559, 4560

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 4258, 4404, 4424, 4425, 4426, 4429, 4430, 4440, 4663, 4928, 4932

4873 (BNL—41896) Manufacture and testing of 465 km superconducting cable for the HERA dipole magnets. Maix, R.K.; Salathe, D.; Wipf, S.L.; Garber, M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 5p. (CONF-880812—23). NTIS, PC A02/MF A01. Order Number DE89002908/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

The production of 465 km of keystoned superconducting cable for the HERA dipoles has been completed in July 1988. The specifications for DESY set challenging requirements, such as a minimum critical current of 8000 A at 5.5 T and 4.6 K and the goal to keep the cable's I within +- 2%. Experience concerning the strand and cable manufacturing are presented together with some of the mechanical and electrical data. A comparison of the critical currents of the cables with the sum of the critical currents of the 24 individual strands before cabling shows that with the usual definition the cables have practically no degradation. Finally, it is shown how different cable compactions and an additional calibration run through the cabling machine influence the critical current. 6 refs., 5 figs.

4874 (CESI—86-30) Low voltage asyncronous motors: performance optimization. Buccianti, R.; Parasiliti, F.; Spada, P. (Centro Elecctrotecnico Sperimentale Italiano, Milan). Nov 1986. 10p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770046/JAW.

The use of voltage controls to improve the energy efficiency of low voltage three phase asyncronous motors is discussed. The results of experimental studies carried out in Italian laboratories are graphically illustrated. A cost benefit analysis shows that the higher cost of these motors is easily compensated by the savings in energy costs during the service life of these machines.

4875 (CFP-T—27) Alaska oil and gas drilling and production equipment, services and technology opportunities. (Department of External Affairs, Ottawa, Ontario (Canada)). [1988]. 312p. (MICROLOG—88-04646). Canada Dept. of External Affairs, Lester B. Pearson Bldg., 125 Sussex Dr., Ottawa, Ont., Canada K1A 0G2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The main object of this study was to examine the drilling and production equipment, services and technology requirements of the Alaska oil and gas industry, in relation to export opportunities for Canadian industry. An outline is presented of current and future activities in Alaska, both onshore and offshore, identifying key companies and contacts with respect to design, specification and buying decisions. The export market potential is evaluated, in general terms, for all sectors including services, technology and manufacturers, and this report attempts to address as many aspects of the Alaska oil business as are reasonably practicable. Aspects of pricing are discussed, including exchange, transportation, duties, tariffs, and fees. Marketing strategies are suggested for Canadian industry to tap the Alaskan market. In general, the report shows that oil and gas exploration and production activity in Alaska is likely to increase, and the size of this activity is already large in scale. Canada's industry base is in a strong position to respond to export opportunities that exist. Areas of Canadian expertise include: oil field equipment experience in northern conditions; gas processing equipment and materials; cold weather operations; enhanced oil recovery; heavy oil recovery and production; and drilling technology in general. 34 figs., 7 tabs.

4876 (CONF-881140—6) Integration of robotics and teleoperation for the advanced servomanipulator: Consolidated Fuel Reprocessing Program. Corbett, G.K.; Noakes, M.W.; Kring, C.T. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE88015281/JAW.

From 2. international symposium on robotics and manufacturing research, education and applications; Albuquerque, NM, USA (16 Nov 1988).

A robotic mode has been added to the Advanced Servomanipulator (ASM), a six degree-of-freedom master/slave teleoperator. In order to understand the requirements for implementation of robotics on an arm designed for teleoperation, a dynamic simulation of the ASM slave arm was developed. The ASM model and modifications of the control system and interface software for robotic operation are presented, along with some preliminary robotic mode performance results. 6 refs., 3 figs.

4877 **(DOE/CE/15384—T1) Textured substrate method for the direct continuous casting of steel sheet: Technical progress report No. 1.** Gaspar, T. (Ribbon Technology Corp., Gahanna, OH (USA)). 21 Oct 1988. Contract FG01-88CE15384. 5p. NTIS, PC A02/MF A01. Order Number DE89003290/JAW.

The overall objective of this research project will be to demonstrate the feasibility of casting rapidly solidified steel strip 2 mm (0.080 in.) thick or greater using a textured chill block as described in US Patent No. 4,705,095, issued on November 10, 1987, to Ribbon Technology Corporation. The effect of melt overflow process variables on strip dimensions and uniformity will be investigated. Process variables include, but are not limited to, the following: super heat of the melt; wetting of substrate material; tundish design; and casting speed. Type 304 stainless steel and AISI 1020 standard carbon steel will be investigated.

4878 **(DOE/ER/10049—1) Joint industry/university research program: Phases IV-VI: Final technical report for the period July 1, 1980 to August 31, 1983.** Compton, W.D. (Ford Motor Co., Dearborn, MI (USA). Research Staff). 15 May 1984. Contract AC02-78ER10049. 211p. NTIS, PC A10/MF A01. Order Number DE89003029/JAW.

On July 1, 1978, a joint Ford/university research program was initiated under DOE's sponsorship. The program was designed to be a new, innovative approach to industry/university liaison and had the following objectives: to conduct energy-related research of mutual interest to Ford Motor Company, the universities and the DOE; and to effect an enhancement in the quality and relevance of the research to national needs through interactions between the university and industrial personnel. It was envisioned that graduate students would spend a portion of their time at the Ford Research Laboratories and that Ford Research Investigators would also visit the universities from time to time. Ford would benefit from contact with new viewpoints emanating from the academic scientists, and in turn, the students and faculty would develop an understanding of the practical needs of industry. 12 refs.

4879 **(DOE/ER/13846—1) Mathematical models of hysteresis: Progress report, January 1988--December 1988.** Mayergoyz, I.D. (Maryland Univ., College Park (USA). Dept. of Electrical Engineering). Aug 1988. Contract FG05-88ER13846. 5p. NTIS, PC A02/MF A01. Order Number DE89003438/JAW.

This report briefly discusses: nonlinear and dynamic scalar Preisach models of hysteresis; vector Preisach model of hysteresis; and software implementation of these hysteresis models. (LSP)

4880 **(DOE/ET/29159—T9) Demonstration of an advanced superconducting generator: Interim report, December 16, 1981--May 15, 1982.** (Massachusetts Inst. of Tech., Cambridge (USA). School of Engineering). 3 Nov 1982. Contract AT01-76ET29159. 59p. NTIS, PC A04. Order Number DE89003299/JAW.

The objective of this program, "Demonstration of an Advanced Superconducting Generator," is to demonstrate advanced concepts in a prototype superconducting generator. Starting in August 1976, concept study and analysis lead in December 1977 to the selection of concepts for the experimental generator. Continued analysis and design optimization of the selected concepts lead to a design selection for the 10 MVA experiment in November 1978. Iteration with detail design and the application of more accurate analysis resulted in a freeze of the "fine tuned" design in September 1978. By May 1980 all secondary design decisions had been made and all major components and materials had been ordered. By December 1980 the installation of the gas turbine prime mover and the helium refrigerator/liquefier had been completed and fabrication had commenced on the stator core and the armature of the experimental generator. Detail designs were completed and component development and fabrication was carried out during 1981. Work during this report period includes fabrication of the armature and rotor as well as the completion of additional component development tests.

4881 **(DOE/SF/16609—T1) Comparative analysis of core drilling and rotary drilling in volcanic terrane.** Flynn, T.; Trexler, D.T.; Wallace, R.H. Jr. (ed.). (Nevada Univ., Reno (USA). Div. of Earth Sciences). Apr 1987. Contract AP03-86SF16609. 103p. NTIS, PC A06/MF A01. Order Number DE89001754/JAW.

Initially, the goal of this report is to compare and contrast penetration rates of rotary-mud drilling and core drilling in young volcanic terranes. It is widely recognized that areas containing an abundance of recent volcanic rocks are excellent targets for geothermal resources. Exploration programs depend heavily upon reliable subsurface information, because surface geophysical methods may be ineffective, inconclusive, or both. Past exploration drilling programs have mainly relied upon rotary-mud rigs for virtually all drilling activity. Core-drilling became popular several years ago, because it could deal effectively with two major problems encountered in young volcanic terranes: very hard, abrasive rock and extreme difficulty in controlling loss of circulation. In addition to overcoming these difficulties, core-drilling produced subsurface samples (core) that defined lithostratigraphy, structure and fractures far better than drill-chips. It seemed that the only negative aspect of core drilling was cost. The cost-per-foot may be two to three times higher than an "initial quote" for rotary drilling. In addition, penetration rates for comparable rock-types are often much lower for coring operations. This report also seeks to identify the extent of wireline core drilling (core-drilling using wireline retrieval) as a geothermal exploration tool. 25 refs., 21 figs., 13 tabs.

4882 **(LA-UR—88-3730) Criticality alarm system verification at the Los Alamos critical experiments facility: Past experience and present capabilities.** Plassmann, E.A.; Spriggs, G.D. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8809144—7). NTIS, PC A02/MF A01. Order Number DE89003482/JAW.

From DOE criticality alarm system workshop; Richland, WA, USA (20 Sep 1988).

The Los Alamos Critical Experiments Facility (LACEF) has been involved in the testing and evaluation of criticality accident alarm systems since 1980. At that time we designed and built the solution critical assembly SHEBA for this purpose. The response of the alarms to neutron pulses was done using the GODIVA-IV Burst Assembly. Currently, SHEBA and a new fast assembly, SKUA, are being modified for burst operation. 8 refs., 7 figs., 2 tabs.

4883 **(LA-UR—88-3792) Potential application of the Los Alamos free-electron laser: High-temperature superconductors.** Lumpkin, A.H. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8808146—9). NTIS, PC A03/MF A01. Order Number DE89003442/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

An improved understanding of High-Temperature Superconductors (HTSCs) should result from the direct investigation of the energy gap associated with the superconducting state. An adaptation of the classic transmission experiments using a broadly tunable Free- Electron Laser (FEL) to irradiate the HTSC single crystals or thin films as a function of photon energy and sample temperature is described. In particular, the Los Alamos FEL has a projected tuning range of 9-160μm (140-8 MeV). In addition, its 10 to 20-ps micropulse structure, linear polarization, coherence, monochromaticity, focusability and peak power features should make it a unique research tool for probing HTSCs with critical temperature (T/sub c/) from {approximately}30 to {approximately}400 K (depending on the energy gaps involved). 14 refs., 4 figs., 2 tabs.

4884 (SAND—86-7176) **Internal and external acoustics and large structures dynamics of cavitating self-resonating water jets.** Chahine, G.L.; Johnson, V.E. Jr.; Kalumuck, K.M.; Perdue, T.O.; Waxman, D.N.; Frederick, G.S.; Watson, R.E. (Sandia National Labs., Albuquerque, NM (USA); Tracor Hydronautics, Inc., Laurel, MD (USA)). Oct 1987. Contract AC04-76DP00789. 265p. NTIS, PC A12/MF A01 - OSTI. Order Number DE89000625/JAW.

This report describes theoretical and experimental work done by Tracor-Hydronautics on structured, resonating jets to be used in rock-drilling bits. This is a continuation of earlier work, done under contract to Sandia, in the development of cavitating and resonating jets. The phase of the project includes the construction of a large scale flow visualization facility, experiments in the facility, analysis of the experimental data, and some extensions of the acoustic and hydrodynamic theories. All of this effort was directed at the flow regime encompassing high velocity, large pressure fluctuations, non-vanishing Mach numbers, and low cavitation numbers. 24 refs., 94 figs.

4885 (SAND—88-2485) **Penetration into dry porous rock: A numerical study on sliding friction simulation.** Chen, E.P. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1988. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01. Order Number DE89002994/JAW.

Penetration of Antelope tuff targets by steel penetrators is the subject of discussion in the present investigation. Specifically, the effect of sliding friction between projectile and target on penetration is examined. The finite element code PRONTO 2D is used to perform a parametric study of the coefficient of friction. Both constant and velocity dependent coefficient of friction representation have been included in the current investigation. Results indicate that increases in the coefficient of friction increase the penetration resistance although the relationship is nonlinear in nature. In terms of peak deceleration and depth of penetration, both the constant and velocity dependent coefficient of friction representation provide almost identical results. However, only the velocity dependent cases show the characteristic of increasing deceleration prior to the conclusion of the penetration event. For this reason, the velocity dependent representation of the coefficient of friction is preferred over the constant friction coefficient representation. 8 refs., 13 figs., 1 tab.

4886 (SAND—88-2658) **The electrostatic discharge threat environment data base and recommended baseline stockpile-to-target sequence specifications.** Fisher, R.J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 56p. NTIS, PC A03/MF A01. Order Number DE89002825/JAW.

An extensive review of the existing data base on the human electrostatic discharge event has been conducted. Based on the data identified, a modified human ESD environment has been proposed for adoption into future STSs. This environment is based on the observed waveform now regarded by the ESD technical community as representing the worst-case stress to components, either electronic or ordnance, in terms of peak amplitude, risetime/riserate, and total pulse energy. The environment is defined by means of a linear passive circuit equivalent of the charged human body that is only slightly more complex than circuit models appearing in existing STSs. Values for the R, L, and C circuit elements are selected from the most reliable measured data found during the literature review in such a way as to result in a practical extreme environment, as is dictated by DOE-DNA TP 50-20, which defines the functions and format of an STS. The model produces an environment in good agreement with measured extreme human ESD events. 41 refs., 18 figs., 8 tabs.

4887 (SAND—88-2841C) **Sample size selection for reliability allocation using supplementary information.** Prairie, R.R.; Zimmer, W.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 9p. (CONF-881242—1). NTIS, PC A02/MF A01. Order Number DE89001683/JAW.

From International symposium on quality control and reliability (IASTED); Los Angeles, CA, USA (12 Dec 1988).

A procedure is described for the selection of sample size for reliability allocation verification that incorporates such factors as engineering judgment, data from similar components and other information in a consistent and efficient manner. If the information about the component limits the range of possible values for the reliability, the required sample size may be reduced while acceptable assessments of reliability are maintained. It is shown that for the usual range of interest, the allowed fraction reduction, f, in the sample size is a function of only the ratio of the allocation requirement and the limit on the possible reliability values. A table illustrating the sample size reduction is presented. 3 refs., 1 tab.

4888 (SRC—TR188, pp 98-99) **Research and development.** Shook, C.A. (Univ. of Saskatchewan, Saskatoon). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper outlines directions for future research and development activities that are recommended for improving knowledge of slurry pipelines. The most important area is felt to be hydraulic studies of systems with interesting properties, such as the effect of additives. Other important areas of research would be modelling studies, commercial scale studies of slurries of industrial importance, studies of wear and of particle degradation during transport, and ancillary transport system studies including coal cleaning and slurry dewatering. 1 ref.

4889 (SRC—TR188, pp 95-97) **Regulatory aspects.** Leeuwenburgh, A.B. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

In this paper, the jurisdictions of the National Energy Board of Canada, the Canadian Transport Commission and provincial boards or other authorities over slurry pipelines are examined. It is shown that the National Energy Board regulates pipelines, but the definition of a pipeline as used in its regulations refers to oil or gas pipelines only. The Canadian Transport Commission has jurisdiction over bulk commodity transport, and regulation as centered mainly on railway transport. Jurisdiction over pipeline transport is given to the Commission as a residual authority relative to National Energy Board jurisdiction, i.e. over any pipeline transporting commodities other than those defined as being under the Board's jurisdiction. In Alberta, pipelines are regulated under the Alberta Pipeline Act, whose definition of a pipeline does include slurry pipelines. The regulatory aspects of slurry pipelines in the USA are more complicated and the regulatory process is not clearly defined. This paper concludes with brief discussions of pipeline codes and standards as they have been adopted by the Canadian regulatory agencies previously mentioned, and a discussion of permit applications for Canadian slurry pipeline systems to the Canadian Transport Commission. As no applications have yet been made for slurry pipelines under federal jurisdiction, this aspect of pipeline regulation has yet to be tested. 3 refs.

4890 (SRC—TR188, pp 89-94) **Slurry pipeline costs.** Hladun, A.R. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper deals with the financial considerations involved in constructing and operating slurry pipelines in Canada. Capital costs include the slurry preparation facilities, the pipeline and associated equipment, and the slurry receiving facilities. Slurry pipeline systems are not too different in pipeline costs from conventional oil pipeline systems; a preliminary estimate of the capital costs can be calculated using the methods indicated in this paper. Operating costs of a typical long distance system are made up of the following items: energy costs; operational and management staff payroll; office and operations overheads; property taxes; insurance costs; and loss of product. Having established the expected capital and operating costs of a particular system, the unit transportation costs over the life of a project can be computed, and a general overview of the financial variables involved in such a computation is present-

ed. A case study is used to illustrate the calculation methods described in this paper. 4 refs., 4 tabs.

4891 (SRC—TR188, pp 86-88) **Planning and scheduling.** Hladun, A.R. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper opens with the logistics considerations in conceiving, designing and constructing slurry pipeline systems. For major projects the logistic considerations are similar to those of any major cross-country pipeline system. For smaller projects and projects that are part of other facilities, the logistics considerations are intertwined with the overall facility and hence cannot be addressed separately. The remainder of this paper discusses some of the planning and scheduling considerations that go into pipeline projects. It then discusses construction planning and logistics consideration, transportation infrastructures and finally methods to put a pipeline system into operation.

4892 (SRC—TR188, pp 83-85) **Environmental aspects.** Guy, P. (Monenco Consultants Ltd.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

The purpose of this paper is to identify the potential environmental implications of slurry pipeline construction, operation and maintenance. It also provides an assessment of some of the technologies and practices available to minimize the environmental effects of slurry pipeline construction and operation. Modern construction and reclamation techniques ensure that most of the environmental impacts of pipeline construction are minimal and short-term. The capability of agricultural and forest land will, however, be reduced for longer periods. During operation, most of the impacts relate to the interactions of the associated pipeline facilities with the environment. If water is used as a transport medium, the impacts associated with its availability at the origin and its disposal at the destination have to be considered. 3 refs.

4893 (SRC—TR188, pp 76-82) **Construction practice.** Leeuwenburgh, A.B. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

An outline is presented of construction practice for slurry pipelines. In general, these do not differ significantly from current oil/gas pipeline practice. Preconstruction activities include route selection, land acquisition, surveys, and construction tendering; conventional construction activities include clearing right-of-way, ditching, bending, welding, testing, backfilling and cleanup. Typical means of controlling erosion on the rights-of way are illustrated. Above-ground construction, as for example in permafrost zones, is briefly discussed. 3 refs., 3 figs.

4894 (SRC—TR188, pp 72-82) **Engineering standards.** Leeuwenburgh, A.B.; Daudi, K.R. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper discusses the development of national codes of slurry pipeline systems and basic requirements of safety and performance standards for principal system components. While standards for liquid pipelines have been fully developed in the USA and Canada, work on slurry pipeline standards has only just begun. Proposed codes are being designed based on standards for oil pipeline systems. As for standards on safety and performance of slurry pipeline equipment and materials, a number of already-existing standards fulfil the requirements for some aspects of slurry systems, such as pipe materials. Recommendations are made as to which US and Canadian standards should be considered by designers of slurry pipelines when considering materials, design criteria, quality control, and corrosion/erosion wear.

4895 (SRC—TR188, pp 70-71) **Slurry testing.** Shook, C.A. (Univ. of Saskatchewan, Saskatoon). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

The advantages of slurry testing include the establishing of conditions for minimum flow velocity, hence minimum energy consumption in pumping and minimum wear on the system. The main purpose of testing, however, is to establish the hydraulic performance of the slurry in the conditions for which stable, trouble-free operation is necessary. Since slurry flow is usually non-Newtonian and of a complex rheological character, a small test pipeline is usually preferable for use in the test program. Pipeline tests can provide deposit velocities, viscosity measurements, laminar/tubulent flow transition data, and indications of pump efficiencies, friction losses and other phenomena necessary for predicting performance of the full-scale system. 2 refs., 1 tab.

4896 (SRC—TR188, pp 64-69) **Slurry dewatering.** Moreland, C.M. (Philips Barret Kaiser). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

The objective in dewatering a liquid/solids slurry in conjunction with pipelining is to return the solids to a condition wherein they can be stored, reclaimed and handled with the same ease as before being slurried. The necessity of dewatering varies depending on the type of process involved. In commerical pipelines, the solids being transported are fine, and generally the water is not compatible with the client's process. Dewatering is a significant part of capital and operating costs of a slurry pipeline system. It can be done mechanically, by screening, centrifuging, filtration, and thickening, or can be done thermally if a dry solid (maximum surface moisture ca 7%) is required. The dewatering processes used can depend on the particle size distribution of the slurry, and the equipment choices - including vibrating screens, centrifuges, filters, and other separation devices - are evaluated. For some end uses, dewatering is not required; in the case of coal-fired power plants, one possibility is direct firing of a high density coal slurry. 4 figs.

4897 (SRC—TR188, pp 44-63) **Slurry pipeline design.** Leeuwenburgh, A.B. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper presents general principles for designing slurry pipelines. Route selection for slurry pipelines does not differ significantly from the work done for a liquid pipeline system, the major difference being that the slopes should be kept below a maximum gradient. Hydraulic design is more difficult than for liquid pipelines, because the hydraulic properties of the slurry are not generally known. Detailed laboratory testing is usually necessary. One important design criterion to establish is the slurry velocity, since too low a velocity will cause solids to settle, while too high a velocity will cause greater erosion and friction losses, and increase power requirements. Slurry properties of importance to the designer include the viscosity, density, and particle size and distribution; depending on the type of pipeline under consideration, some of these properties can be varied and others may be fixed. Pressure drop calculations are outlined for homogeneous, pseudohomogeneous, heterogeneous, and coarse particle solids flow. Mechanical design for slurry pipelines is similar to that for liquid pipelines, with the addition of allowances for erosion or corrosion-erosion. Main features to be considered in the design of equipment for slurry systems are resistance to abrasive wear and the elimination of cavities in valves which could fill up with solids. Pump station design, and instrumentation/control systems, also differ little from liquid pipeline systems. Case studies are used to present sample calculations and designs for a short mine tailings line, a long distance coal/water pipeline, and a short pipeline moving coarse coal particles. 8 refs., 5 figs. 7 tabs.

4898 (SRC—TR188, pp 32-43) **Slurry flow principles.** Shook, C.A. (Univ. of Saskatchewan, Saskatoon). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

Slurry flow phenomena are determined by the properties of the slurry and the conditions of the flow. Slurry properties depend on characteristics of the particles, those of the fluid, and the properties of the fluid-particle interface which are determined by the compositions of the fluid and the solids. Flow conditions depend upon the pipeline geometry, history and system variables. Faced with the complexity of slurry flow, this paper takes the simplest course, that of describing limiting cases or flow regimes which are clearly distinctive. Actual slurry flows will fall somewhere between these cases. Liquid flows are either laminar or turbulent and the difference between them can be established in a variety of ways. Although the laminar or turbulent distinction is important for slurries, it is less critical than differences which arise from the fact that two phases are present. Thus for slurries, it is the extent to which the mixture resembles a true liquid which is of primary importance. Three limiting cases are identified to reflect behavior: essentially identical to liquid flow (homogeneous flow); having some similarity to liquid flows (pseudohomogeneous flows); or profoundly different from liquid flows (segregated flows). This classification reflects the importance of the distribution of particles within the flow field. This distribution depends upon the balance of forces acting on the particles, a subject of which understanding remains incomplete. 11 refs., 5 figs., 4 tabs.

4899 (SRC—TR188, pp 25-31) **Slurry pumps.** Rizzone, M.L. (Wilson Snyder Pumps). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

Pumps which are used to move a slurry in a pipeline may be of several types. Centrifugal and reciprocating pumps usually are employed; however, other types such as diaphram, Moyno, surge leg, oil/slurry interface, lockhoppers, jet pumps, and air lifts can be considered. Each has limitations and may be fitted into systems in which their particular characteristics may justify the selection. This paper emphasizes those factors which should be considered when applying centrifugal or reciprocating pumps for pipeline service. 4 refs., 11 figs.

4900 (SRC—TR188, pp 21-24) **Slurry preparation.** Mmoreland, C.M. (Phillips Barret Kaiser). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

The objective in preparing a liquid-solid slurry for pipelining is to take granular solids and combine them with appropriate amounts of water so that they can be stored, reclaimed and handled with ease. Production of the slurry in a form suitable for pumping, whether short or long distances, is the desired output. Proper design of the slurry preparation facility includes process design and equipment selection based upon the desired slurry characteristics and the feed solids size distribution and characteristics. If the solids are produced from a hydraulic mine or cleaned in a preparation plant, some of the slurry preparation steps can be eliminated. 13 refs., 1 fig.

4901 (SRC—TR188, pp 7-16) **Conventional liquids pipeline design.** Leeuwenburgh, A.B. (Monenco Engineers and Constructors, Inc.). Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

This paper gives an overview of the design of conventional liquid pipelines, in order to provide a background for other papers in this book which describe the design of slurry pipelines. Route selection, normally done by taking the shortest practical distance between the end points of the pipeline, provides the designer with a reasonable estimate of the length of the line. Hydraulic design encompasses several activities, including selection of pipe diameter, calculation of pressure drop as a function of pipeline properties, flow velocity, and fluid properties; economic considerations are also important, especially in pipe selection. Pumping requirements can then be calculated, and the hydraulic gradients and transient flow characteristics evaluated. Mechanical design for pipelines is generally minimal, the main areas of concern being the aboveground facilities and areas of pipeline stress such as sharp bends. Pumping facilities are sited according to topography, operating conditions and maximum operating pressure, and pump types are selected according to conditions of service, fluids to be pumped, and availability. The centrifugal single or two-stage pump is most commonly used for long distance and high volume pipelines. Sample calculations are included. 11 refs., 3 figs., 1 tab.

4902 (SRC—TR188, pp 3-6) **Historical development of slurry pipelines.** Husband, W.H.W. Dec 1986. Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN. (CE—02010).

In Slurry pipeline manual. Design and construction.

Hydraulic transport of solids through pipelines has been developed steadily since the adaptation of the centrifugal pump to slurries in the 1860s. The ever-widening scope of slurry pipeline transport was not accompanied initially with definite improvements in the technology, except for improved centrifugal pump design to allow larger solids to be pumped in greater quantities over longer distances without unacceptable pump wear rates. Before 1950, hydraulic transport systems were designed on the basis of previous experience and the use of published data correlations which could not be applied beyond the range of practical experience with any confidence. Nevertheless, hydraulic transport became firmly established in the chemical, mining and civil engineering industries because of the advantages it offered in regards to cost and convenience, and in many cases due to the impracticability of using any other method. In the 1950s, a beginning was made to correlating the flow parameters of solid-liquid mixtures in the form of fairly stable supsensions for the design and optimization of hydraulic transport systems. This process has continued and designers now have methods for both stable and coarse suspensions. As requirements became more demanding, positive displacement pumps began to complement the centrifugal pump and now deliver the high pressure flows required by long distance slurry pipelines Improvements in pipe materials, methods of pipeline construction, and pumps, now permit pipelines of 1,000 km or more operating at high pressures to deliver as much as 25 million tonnes per year of solid material. 3 refs., 1 fig.

4903 **(SRC—TR188) Slurry pipeline manual. Design and construction.** Husband, W.H.W. (ed.). (Saskatchewan Research Council, Saskatoon (Canada)). Dec 1986. 102p. (CE—02010). Saskatchewan Research Council, 30 Campus Dr., Saskatoon, Sask., Canada S7N 0X1; $30.00. OTHER COUNTRIES $35.00 CAN.

Results of more than fifteen years of Canadian research expertise on slurry pipelines have been consolidated into a comprehensive and practical design and construction manual. The manual is directed towards undergraduate and practising engineers engaged in the planning, design, evaluation and regulation of slurry pipelines and aims to achieve maximum technology transfer in the field. Seventeen chapters cover the full range of subject matter from historical development of slurry pipelines through conventional liquids pipeline design and slurry preparation, flow principles, pipeline design, pumping, testing, dewatering, environmental aspects, standards, costs, regulatory aspects and research and development needs. Separate abstracts have been prepared for 16 papers from this manual.

4904 **(UCID—21534) Analysis of interferometer images with Fourier domain techniques.** Van Arsdall, P.J. (Lawrence Livermore National Lab., CA (USA)). 1 May 1988. Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01. Order Number DE89002927/JAW.

This article discusses our interactive analysis system for processing interferograms digitized from video images. The technique used is based on angle modulation theory, in which a large amount of tilt is introduced into one arm of the interferometer. The

tilt component then serves as a spatial carrier to the modulating wave-front phase. Fourier-domain bandpass processing of the interference fringes effectively removes the adverse effects of irradiance variations and camera background signals. We describe this two-dimensional signal-processing technique and present wave-front measurements made during tests of the zig-zag amplifier for the High Average Power Program. 9 refs., 6 figs.

4905 **(UCRL—53891) Fire exposure to an office trailer complex.** Beason, D.; Foote, K.; Priante, S.; Staggs, K. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 18p. NTIS, PC A03/MF A01. Order Number DE89002818/JAW.

The hazard of fire exposure between adjacent buildings has been a concern within the Department of Energy and at the Lawrence Livermore National Laboratory (LLNL). We have used many codes, standards and local directives to determine the appropriate fire separation distance for placing new trailers adjacent to our existing facilities. The Fire Science Group secured an office trailer complex that was scheduled for demolition and conducted a full-scale fire test to observe and quantify the fire behavior of trailers at separation distances typical for LLNL. The test series included external fire exposure from pool fires of kerosene and a final full-scale test of one trailer in complete burning condition exposing another trailer at a 15-foot separation distance. This behavior--although not general--may serve as a reference for future fire-protection evaluations at LLNL. It may also serve as a starting point for planning a test program to obtain data needed as a basis for revising or validating trailer standards used at DOE facilities. 3 refs., 30 figs.

4906 **(UCRL—97384-Rev.1) STARFIRE: Hypervelocity railgun development for high-pressure research.** Hawke, R.S.; Susoeff, A.R.; Asay, J.R.; Balk, J.K.; Hall, C.A.; Konrad, C.H.; McDonald, J.M.; Schuler, K.W.; Wellman, G.W.; Hickman, R.J. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1988. Contract W-7405-ENG-48;AC04-76DP00789. 6p. (CONF-880478—10-Rev.1). NTIS, PC A02/MF A01. Order Number DE89003269/JAW.

From 4. symposium on electromagnetic launch technology; Austin, TX, USA (12 Apr 1988).

STARFIRE, a program based at Sandia National Laboratories, has as its goal the development of a hypervelocity railgun for use as a high-pressure research tool. The program has included efforts to identify and solve the problems that have inhibited reliable attainment of velocities greater than the 8 to 9 km/s attainable with two-stage light-gas guns (2SLGG). Issues studied include: (1) plasma arc formation and stabilization, (2) restrike inhibition, (3) viscous drag, (4) ratio of preload to operating stresses, (5) barrel joint design, and (6) barrel precision requirements. The system uses a 2SLGG as an injector to minimize barrel ablation and armature contamination. Hydrogen is used as the injection gas and will also serve to reduce the probability of forming secondary arcs. A VISAR optical Doppler system is used to continuously and precisely measure the projectile velocity from a standing start in the 2SLGG barrel, through several joints, the HELEOS (Hypervelocity Experimental Launcher for Equation of State) railgun barrel, and post-launch. The STARFIRE program is focused on the combined use of precision diagnostics and new experimental techniques. Results of tests are presented. 24 refs., 7 figs., 1 tab.

4907 **(UCRL—97385-Rev.1) Plasma armature formation in high-pressure high-velocity hydrogen.** Hawke, R.S.; Susoeff, A.R.; Asay, J.R.; Hall, C.A.; Konrad, C.H.; Hickman, R.J.; Sauve, J.L. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1988. Contract W-7405-ENG-48;AC04-76DP00789. 5p. (CONF-880478—11-Rev.1). NTIS, PC A02/MF A01. Order Number DE89003271/JAW.

From 4. symposium on electromagnetic launch technology; Austin, TX, USA (12 Apr 1988).

The use of a two-stage light-gas gun (2SLGG) as a preaccelerator in combination with a railgun is expected to significantly reduce barrel ablation and improve overall performance. In particular, the use of a hydrogen 2SLGG provides injection velocities of 6 to 8 km/s and a pure hydrogen environment immediately behind the projectile as it enters a railgun. To continue acceleration of the projectile, a plasma armature must be formed. We explored two methods of converting a portion of the fast-moving hydrogen gas into a plasma armature capable of supporting currents exceeding 100 kA. We report on the results of these studies. This work is part of STARFIRE, the joint Sandia National Laboratories/Lawrence Livermore National Laboratory project to develop a hypervelocity railgun. 11 refs., 4 figs., 1 tab.

4908 **(WHC-SA—0402) Experience with neutron criticality alarm systems at Westinghouse Hanford Company.** Paglieri, J.N.; Conner, R.P. (Westinghouse Hanford Co., Richland, WA (USA)). Sep 1988. Contract AC06-87RL10930. 11p. (CONF-8809144—4). NTIS, PC A03/MF A01. Order Number DE89001910/JAW.

From DOE criticality alarm system workshop; Richland, WA, USA (20 Sep 1988).

The neutron-sensitive criticality alarm system developed at the Hanford Site was installed in a number of buildings and has demonstrated satisfactory performance during approximately 20 yr of operation. Neutron detection is provided by a boron-10 trifluoride (BR_3) tube in each detector. A description of the criticality alarm system is provided and the results of testing with short duration radiation pulses are discussed. Early and long-term operating experience is addressed including resolution of operating problems, spurious alarms, and trip levels. Modification, testing, and maintenance of the system is discussed including lessons learned. The commercial neutron-sensitive criticality alarm system was recently installed in a large facility is also described. Important aspects of installing/testing the system and operating experience are discussed. 1 ref., 3 figs.

4203 Lasers

REFER ALSO TO CITATION(S) 5682

4909 **(ENEA-RT-TIB—87-50) Lectures on FEL theory.** Dattoli, G.; Torre, A. (ENEA, Rome (Italy)). Feb 1988. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755367/JAW.

In these lectures we cover the essential features of the Free Electron Laser (FEL) theory. We discuss the basic gain mechanism and the problems associated with the FEL operation both in single passage and recirculated (Storage Ring) FEL operation. The problems related to the pulse propagation effects and to the, so called, lethargic behaviour are also analyzed with some detail. Elements of FEL quantum theory are also reported to better clarify the laser process from the microscopic point of view.

4910 **(LA-UR—88-3586) Near-ideal lasing with a uniform wiggler.** Warren, R.W.; Sollid, J.E.; Feldman, D.W.; Stein, W.E.; Johnson, W.J.; Lumpkin, A.H.; Goldstein, J.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 28p. (CONF-8808146—10). NTIS, PC A03/MF A01. Order Number DE89003465/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

Over the years the Los Alamos FEL team has reduced or eliminated many of the experimental problems that resulted in non-ideal lasing. The major problems were accelerator instabilities that cause noise and fluctuations in current, energy, and timing; wake-field effects in the wiggler and beamline that introduce fluctuations in the beam's energy; and mirror nonlinearities caused by free carriers produced in the mirror by the high light levels, which caused extra light losses and interfered with the diagnostics. Lasing is not thought to be ideal in that it lacks major disturbing effects and is limited only by emittance, energy spread, and peak current. In this paper we describe the features of lasing that we have observed over a range of optical power of 1000, from the onset of lasing, to the threshold of the sideband instability, to the organization of regular optical spikes, to the region of chaotic spikes. Cavity-length detuning is presented as an ideal technique, in most circumstances, to completely suppress sidebands. With detuning one can easily switch operating modes from that giving the highest efficiency (chaotic spiking) to that giving the narrowest spectral line (no sidebands). Alternative techniques for sideband suppression normally use some kind of wavelength selective device (e.g., a grating) inserted in the cavity. With detuning, there is no need for such a

device, and, therefore, no conflict between the wavelength control exerted by this extra optical component and that exerted by the energy of the electron beam. Lasing, therefore, starts easily, a shift in wavelength, i.e., chirp, is easily accomplished, and the consequences of inadequate control of the electron beam energy are not severe. 35 refs., 16 figs.

4911 **(LA-UR—88-3758) Numerical simulations of free-electron laser oscillators.** McVey, B.D.; Goldstein, J.C.; Tokar, R.L.; Elliott, C.J.; Gitomer, S.J.; Schmitt, M.J.; Thode, L.E. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 16p. (CONF-8808146—6). NTIS, PC A03/MF A01. Order Number DE89003488/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

A numerical simulation capability has been developed to model the physics and realistic design constraints of free electron laser oscillators driven by rf linear accelerators. Two computer codes have been written FELEX and FELP. The code FELP is a one spatial dimension code with essentially unlimited time or spectral resolution. The codes are complementary and their use is dependent upon the problem being addressed. The code FELP is used to model optical and electron micropulse structure, broadband noise, and the sideband instability. The code FELEX models accelerator generated electron beam distributions, the transport of these distributions through wigglers with misalignments and field errors, self-consistent interaction with the optical field, and propagation of the optical field through resonators with realistically modelled components. FELEX is routinely used to match resonator designs to the optical parameters of the electron beam, and used to investigate the physics of 3-D micropulse effects. Some details of the codes will be presented along with various examples of simulation results. 22 refs., 10 figs., 1 tab.

4912 **(LA-UR—88-3777) Amplified spontaneous emission and pulse train amplification in a KrF amplifier.** Ackerhalt, J.R.; Hanson, D.E.; Adams, R.G.; Raymond, T.D.; Reiser, C.; Rice, J.K.; Michie, R.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881002—26). NTIS, PC A02/MF A01. Order Number DE89003485/JAW.

From 35. national vacuum symposium and 4th international laser science conference; Atlanta, GA, USA (2 Oct 1988).

We present modeling status of pulse-train amplification experiments conducted at Sandia National Laboratory in Albuquerque (SNLA) with an e-beam pumped KrF laser amplifier. The laser geometry is such that the dominant amplified spontaneous emission (ASE) growth is along the propagation axis. Our numerical studies include the propagation of on axis co- and counter-propagating fields for both the pulse train and ASE simultaneously. The time-dependent gain, absorption, formation and quenching rates are obtained from a state-of-the-art kinetics code developed at Los Alamos National Laboratory (LANL). 12 refs., 12 figs.

4913 **(LA-UR—88-3793) Optical transition radiation measurements for the Los Alamos and Boeing Free-Electron Laser experiments.** Lumpkin, A.H.; Feldman, R.B.; Feldman, D.W.; Apgar, S.A.; Calsten, B.E.; Fiorito, R.B.; Rule, D.W. (Los Alamos National Lab., NM (USA); Naval Surface Warfare Center, Silver Spring, MD (USA)). 1988. Contract W-7405-ENG-36. 18p. (CONF-8808146—8). NTIS, PC A03/MF A01. Order Number DE89003484/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

Optical transition radiation (OTR) measurements of the electron-beam emittance have been performed at a location just before the wiggler in the Los Alamos Free-Electron Laser (FEL) experiment. Beam profiles and beam divergence patterns from a single macropulse were recorded simultaneously using two intensified charge-injection device (CID) television cameras and an optical beamsplitter. Both single-foil OTR and two-foil OTR interference experiments were performed. Preliminary results are compared to a reference variable quadrupole, single screen technique. New aspects of using OTR properties for pointing the e-beam on the FEL oscillator axis, as well as measuring e-beam emittance are addressed. 7 refs., 9 figs.

4914 **(LA-UR—88-3858) Time-resolved spectral measurements for the boeing free-electron laser experiments.** Lumpkin, A.H.; King, N.S.P.; Wilke, M.D.; Wei, S.P.; Davis, K.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 17p. (CONF-8808146—7). NTIS, PC A03/MF A01. Order Number DE89003491/JAW.

From 10. international free-electron laser conference; Jerusalem, Israel (29 Aug 1988).

A time-resolved optical spectrometer based on the integration of a Jarrell-Ash 1/4-m spectrometer and a streak camera has been used to evaluate the Boeing Burst Mode Oscillator experiment. The system provides information on spectral evolution on both the micropulse (10 ps) and macropulse (50-100μs) time scales. We have measured the micropulse duration, a wavelength shift within a micropulse and the development of a discrete second wavelength during a macropulse. 4 refs., 9 figs., 1 tab.

4915 **(UCRL—99042) High-brightness, high-current density cathode for induction linac FELs.** Turner, W.C.; Chen, Y.-J.; Nexsen, W.E.; Green, M.C.; Miram, G.; Nordquist, A.V. (Lawrence Livermore National Lab., CA (USA)). 28 Sep 1988. Contract W-7405-ENG-48. 4p. (CONF-881049—38). NTIS, PC A02/MF A01. Order Number DE89003173/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

We have recently initiated an investigation to determine the intrinsic operating limits of an osmium coated dispenser cathode for use in free-electron lasers (FELs) driven by an induction linear accelerator. The experimental apparatus consists of a 5.1-cm-diam osmium coated dispenser cathode driven by a 250-kV, 10-Ω, 35-ns Blumlein pulse line. The pepper pot technique is used to measure intrinsic cathode brightness and uniformity. Recent measurements have yielded brightness values exceeding 1 {times} 10^{10} A/m^{2}rad^2 for current densities up to 140 A/cm^2. We have also obtained quantitative data on cathode poisoning caused by a number of chemical agents of interest in the induction linac environment. 7 refs., 8 figs., 2 tabs.

4916 **(UCRL—99201) Design and initial operation of ETA-II induction accelerator: Beam Research Program.** Clark, J.C.; Coffield, F.E.; Deadrick, F.J.; Newton, M.A.; Nexsen, W.E.; Prono, D.; Ravenscroft, D.S.; Throop, A.L.; Turner, W.C.; Whitham, K. (Lawrence Livermore National Lab., CA (USA)). 18 Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-881049—39). NTIS, PC A02/MF A01. Order Number DE89003172/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

ETA-II is a high current, high-repetition-rate induction linac designed for use in free-electron laser (FEL) research. ETA-II design is to produce 7.5-MeV, 2-kA, 70-ns pulses at a brightness of 2 {times} 10^9A/(m-rad)^2 with a repetition rate of up to 100 Hz continuous or 5 kHz in burst mode. The pulse power is generated by pulse compression using magnetic switching. The accelerator consists of a 1.5-MeV injector using an M-type dispenser cathode followed by 60 induction cells. Each cell adds 100 keV to the beam ETA-II will be used for brightness transport studies needed for the design of higher energy accelerators for visible-light FELs. ETA-II will also drive a microwave FEL at 140 GHz and 250 GHz for plasma heating experiments in a tokamak. This report will describe the design parameters and initial operation of ETA-II. 1 ref., 9 figs., 2 tabs.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 4131, 4137, 4458, 4459

4917 **(CEGB-TPRD/B—1076/R88) Measurement of local transient temperatures and heat fluxes in film boiling collapse.** Hall, C.M. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Mar 1988. 24p. (CONF-880724—; PWR/HTWG/P—88-595; MFCIWP—88-P67). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755438/JAW.

From 25. American Society of Mechanical Engineers/American Institute of Chemical Engineers/American Nuclear Society national heat transfer conference; Houston, TX, USA (24 Jul 1988).

A new small-scale, rapid response surface thermocouple has been developed. It has been employed in measurements of local transient temperatures and heat fluxes during collapse of a film boiling water drop on the surface of a heated steel block. The measurements were carried out over a range of initial surface temperatures between 150 and 600/sup 0/C and at water subcoolings of 15 and 65 K. The results show that breakdown of film boiling on a solid metal surface leads to a transient microbubble boiling process with a scale of less than 0.5 mm, giving a peak heat flux of up to 6 kWcm/sup -2/. This flux is typically two orders of magnitude greater than that occurring in steady state nucleate boiling. Periodic global oscillations occur in the microbubble boiling layer at a frequency of a few kilohertz; these lead to far field pressure fluctuations and alternating enhancement and reduction of the heat flux. The high fluxes persist for a sufficient time (milliseconds) to cool the metal surface to temperatures at which steady state nucleate boiling can occur. Subsequent behaviour is governed by a combination of the thermal recovery of the chilled surface and heating of the water in the region agitated by the microbubble boiling. The results provide evidence of the detailed mechanisms behind the classical picture of transition boiling as alternating periods of film and nucleate boiling; it is hoped that this could stimulate theoretical modelling. The surface cooling observed in the present experiments suggests that film boiling collapse on molten tin could lead to surface freezing before the occurrence of a steam explosion. The possibility that for some materials the fuel may be bounded by a thin frozen layer should therefore be considered in the analysis of fuel coolant interactions.

4918 **(CISE—4193) Experimental study on reflux condensation inside a tube simulating a U tube of a PWR steam generator.** Marcolongo, V.; Masini, G.; Achilli, A.; Garedolfi, S.; Vescovi, O. (Centro Informazioni Studi Esperienze, Milan (Italy); SIET SpA, Piacenza (Italy)). (Centro Informazioni Studi Esperienze, Milan (Italy)). 1987. 15p. (CONF-8706259—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704678/JAW.

From European two phase flow group meeting; Trondheim, Norway (1 Jun 1987).

A basic experimental study on reflux condensation was carried out in a single tube, vertical test section reproducing at full scale (I.D. 16.87 mm, length 7.14 m) the rising branch of a PWR U-tube steam generator. The secondary side of the steam generator was simulated through a jacket allowing circulation of cooling water. Controlled boundary conditions were pressure (55, 80, 105 bar), inlet steam flow rate (within 2.5 to 10 and 10/sup -3/ Kg/s), inlet cooling water temperature, tube entry geometry (sharp and round edge). A few experimental points were obtained in total reflux condensation, whereas the major part of the work was devoted to the determination of the countercurrent flow limitation. Experimental data were compared with different flooding correlations, showing a comparatively good agreement with the orginal Wallis correlation. Entry geometry has a marked effect, though lower than predictable, shifting the flooding limit to higher steam flow rates for round edge. Local heat transfer measurements were also performed; however comparison with correlation is restricted to complete reflux data.

4919 **(ENEA-RT-TERM—88-4) Theoretical and experimental study of turbulent thermal conductivity of water in direct contact condensation.** Celata, G.P.; Cumo, M.; D'Annibale, F.; Farello, G.E.; Focardi, G. (ENEA, Frascati (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 24p. (CONF-8806273—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704902/JAW.

From Modeling of nuclear and advanced heat transfer components; Bologna, Italy (14 Jun 1988).

An experimental investigation related to the interaction between saturated and superheated steam in quasi-stagnant conditions, and subcooled water in horizontal flow within a rectangular duct test section is presented. A mathematical model for the description of the phenomenon has been developed and tested with the experimental data. The comparison is acceptable and well within the uncertainty band of the experimental measurements.

4920 **(ENEA-RT-TERM—88-5) Transient CHF in flow boiling during flow rate and thermal simultaneous variations.** Celata, G.P.; Cumo, M.; D'Annibale, F.; Farello, G.E. (ENEA, Frascati (Italy). Centro Ricerche Energia). (ENEA, Rome (Italy)). 1988. 31p. (CONF-8805226—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704903/JAW.

From European two-phase flow group meeting; Brussels, Belgium (30 May 1988).

The present paper deals with the results of an experimental investigation on forced flow critical heat flux during transients caused by simultaneous variations of the flow rate and of the thermal power. The two parameters were varied according to an exponential law for what concerns the flow rate decrease, and to a ramp-wise and a step-wise law for the input power increase. Experiments were carried out employing a tubular test section which was electrically and uniformly heated. The test parameters included the flow rate half-flow decay time as well as several values of the initial power (before the transient) and the final power (at the end of the transient), in the case of step-wise transients, and the slope of the ramp in the case of ramp-wise transients. The pressure was kept constant during the transients. An analysis of the experimental data was conducted on the base of the local conditions approach. The effect of the simultaneous variation of the mass flow rate and of the power on the time to crisis has also been analysed with respect to transients in which only one of the two parameters was varied. 19 refs.

4921 **(KFK—4439) Accuracy of several difference schemes for the numerical solution of the two-dimensional convection-diffusion equation, a numerical test using an example with known analytical solution.** Guenther, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Aug 1988. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755972/JAW.

This report describes numerical tests with various difference schemes to solve the convection-diffusion equation. Starting point of this investigation has been a scheme proposed by the author, the so-called 'LECUSSO-scheme', which is of order O(Δx/sup 2/) and avoids unphysical spatial oscillations meaning that this scheme does not suffer from any mesh-Reynolds-number-restriction. To test this scheme a previously described example introduced by Beier et al. with known analytical solution was adoptd and numerically solved using a variety of difference schemes. This is done for a wide range of Reynolds-numbers ($20 \leqq Re' \leqq 5000$) and equidistant meshes of different size, the comparison being done with respect to the space-dependent error and to the maximum spatial error of the numerical solution. The results of the numerical tests may be summarized as follows: Flows with boundary layers, as the most interesting case are very favourably calculated using upwind methods of second or higher order in conservation form with respect to the absolute value of the maximum spatial error. The amount of this error is near 1/3 of the error obtained with standard schemes unless these schemes not yet produced obsolete results since a mesh-Reynolds-number condition had been violated. As to the increased amount of work (additional 5th point, two different additional types of modified difference approximations with fewer points near the boundary), LSUDS-C (in conservation form) is not better than LE-

CUSSO-C and QUICK-PLUS. The reduced errors of the upwind methods of higher order enable us to proceed to the numerical calculation of flows with higher Reynolds-numbers than before. (orig./GL.

4922 (KFK—4450, pp 167-180) **Investigation of phase transport and phase distribution processes in air-water-bubble flow in perpendicular channels.** Class, G.; Eberle, F.; Gering, G.; Meyder, R.; Philipp, P.; Lang, G.; Scharnowell, R.; Sengpiel, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Jun 1988. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88755425/JAW.

In Safety-oriented LWR research. Annual report 1987.

An arrangement for X-ray computer-tomographic measurements of two-dimensional void distributions has been integrated into the new NOVA test facility. The coupling of the TEACH and PASSABLE codes for numerical simulation of turbulent flows with k-ϵ turbulence models including the near-wall region (with extension to low Reynolds number models) has been successfully completed. On the base of this modeling concept, work has been started towards a two-fluid formulation for bubbly two-phase flow calculation with single-phase k-ϵ turbulence models.

4923 (N—88-28312) **Applications of an exponential finite difference technique.** Handschuh, R.F.; Keith, T.G. Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jul 1988. 28p. (NASA-TM—100939; E—4006; AVSCOM-TM—88-C-004; NAS—1.15:100939). NTIS, PC A03/MF A01.

An exponential finite difference scheme first presented by Bhattacharya for one dimensional unsteady heat conduction problems in Cartesian coordinates was extended. The finite difference algorithm developed was used to solve the unsteady diffusion equation in one dimensional cylindrical coordinates and was applied to two and three dimensional conduction problems in Cartesian coordinates. Heat conduction involving variable thermal conductivity was also investigated. The method was used to solve nonlinear partial differential equations in one and two dimensional Cartesian coordinates. Predicted results are compared to exact solutions where available or to results obtained by other numerical methods.

4924 (NP—9770091) **Experimental investigations of vibrating flow in a pipe nozzle with cross section shift.** Selerowicz, W.C.; Szumowski, A.P.; Meier, G.E.A. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Feb 1987. 99p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89770091/JAW.

The investigation of the effect of the parameters of nozzle geometry on the frequency of vibration is at the centre of this work. The structure of the vibrating free jet is also determined and differences between a vibrating and a non-vibrating jet are described. Measurements of pressure variations are also taken at the outlet pipe wall. Finally, the calculation of the frequencies of vibration for various modes of flow are explained. (HAG).

4925 (NP—9770094) **Development of a measurement method for accurate determination of volume flows of gases using laser-Doppler anemometry. Final report.** Dopheide, D.; Taux, G. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Lab. fuer Stroemungsmesstechnik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1987. 41p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770094/JAW.

The subject of this study was to measure volume flows of air in absolute terms in the flow range 200-2,500 cbm/h at an uncertainty of 0.1% only. The measurement method was to detect system errors. The study focusses on the laser-Doppler anemometer, the measuring system and flow measurements. In addition, the calibration of a turbine wheel counter is demonstrated and the findings are summarized. (HAG).

4205 Materials Testing

REFER ALSO TO CITATION(S) 4107, 4185, 4399, 4402, 4431, 4489, 4664, 4710, 4765, 4878, 4905

4926 **(FEI—1826) Methods of mechanical materials testing in the BR-10 nuclear reactor. Technique of automated fast mechanical tests.** Kruglov, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1987. 14p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704177/JAW.

Algorithms of programs for an automated system designed for conducting fast mechanical materials tests including tests during irradiation in the BR-10 reactor channels are described. Basic statistical criteria used for deformation curve analysis are considered. By means of these criteria the parameters characterizing strength properties of the material investigated (ultimate strength, yield strength and relative elongation) are determined. 3 refs.; 5 figs.

4927 **(KCP—613-4032) Analysis of low alloy and stainless steels by inductively coupled argon plasma spectrometer: Final report.** Reimer, H. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.). Nov 1988. Contract AC04-76DP00613. 11p. NTIS, PC A03/MF A01. Order Number DE89003227/JAW.

Eleven elements in low alloy and stainless steels were analyzed using separate sampling and excitation analysis (SSEA). This solid sampling device is used in conjunction with an inductively coupled argon plasma (ICAP) optical emission spectrometer. Samples are eroded by a controlled spark, and the metal aerosol caused by the erosion is swept into an argon plasma to be excited. This short study was undertaken to provide an alternate method of analysis in case of instrument failure during the usual procedure employed in the laboratory. Accuracy and precision studies also were performed. Precision was determined by analyzing the same sample 11 times. Five certified standards used as samples were analyzed to determine accuracy. The precision and confidence intervals were calculated. The precision as percent relative standard deviation ranged from 8.4 percent for aluminum at a concentration of 0.008 percent to 0.48 percent at 27 percent for chromium. 1 ref., 3 tabs.

4928 **(PNL—6737) In plant demonstration of high temperature EM pulser and pulsed EMAT receiver: Final report: Experimental development and testing of ultrasonic system for high temperature applications on hot steel.** Boyd, D.M.; Sperline, P.D. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1988. Contract AC06-76RL01830. 40p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003726/JAW.

This report describes work performed under the Field Work Proposal on the "In-Plant Demonstration of a High-Temperature EM Pulser and pulsed EMAT Receiver" for the Department of Energy's Office of Industrial Programs. Cost sharing by the American Iron and Steel Institute (AISI) helped provide both technical guidance and equipment for the plant demonstration. This report covers the time period from January 1988 through September 1988.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 4106, 4439, 4441, 5033, 5048

4929 **(LA-UR—88-3731) Optimal design of high speed analog APD receivers.** Smith, R.C. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 9p. (CONF-8809105—10). NTIS, PC A02/MF A01. Order Number DE89003481/JAW.

From SPIE O-E Lase: international symposium and exhibition on fiber optics, optoelectronics and laser applications; Boston, MA, USA (6 Sep 1988).

In order to provide optical to electrical conversion of high speed analog signals, avalanche photodiode receivers must be optimized for several parameters. Among these parameters are receiver amplifier noise, APD noise, and bandwidth. Optimization of these

parameters requires a theoretical understanding of each of the parameters and their interactions. In the first part of this paper the theoretical design of an avalanche photodiode optical receiver will be discussed with attention to the parameters mentioned. Later, a comparison between calculated and measured values for a receiver design will be presented. 6 refs., 3 figs.

4930 **(LBL—25113) New Al-Ni-Ge contacts on GaAs: Their structure and electrical properties.** Liliental-Weber, Z.; Washburn, J.; Musgrave, C.; Weber, E.R.; Zuleeg, R.; Lampert, W.V.; Haas, T.W. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering; Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA). Materials Lab.). Mar 1988. Contract AC03-76SF00098. 9p. (CONF-880408—41). NTIS, PC A02/MF A01. Order Number DE89002918/JAW.

From Spring meeting of the Materials Research Society; Reno, NV, United States (4 Apr 1988).

The structure and composition of the recently developed Al-Ni-GE ohmic contacts to n-GaAs were investigated by transmission electron microscopy combined with secondary ion mass spectroscopy (SIMS) and Auger spectroscopy. The semiconductor/metal-alloy interface of these contacts remain very flat after annealing (500{degree}C, for 1 min - contact resistance 0.4 {times} 10/sup {minus}6/Ωcm^2), in contrast to the widely used Au-Ni-Ge contacts. The metal sequence during deposition is found to be a critical factor in determining the electrical contact properties and the dispersion of the oxide layer on the semiconductor surface after chemical cleaning. Ge doping of the GaAs beneath the contact layer was observed by SIMS, and a tunneling mechanism through the N^+ GaAs:Ge layer was proposed to explain the ohmic properties of the contacts. 12 refs., 7 figs.

4931 **(SAND—88-0946C) Stress driven diffusive voiding of aluminum conductor lines: A model for time dependent failure.** Yost, F.G.; Romig, A.D. Jr.; Bourcier, R.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 16p. (CONF-880901—8). NTIS, PC A03/MF A01. Order Number DE89001665/JAW.

From Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, IL, USA (24 Sep 1988).

Cracking or voiding of passivated aluminum conductor lines in integrated circuits has been observed by many workers since 1984. This problem has been brought on by the trend in the microelectronics industry to miniaturize circuitry. Most reports on the subject attribute the cause to diffusion creep. This report points out certain difficulties with this conclusion and presents the essential features of a related failure mechanism. A numerical stress analysis is presented to illustrate stress gradients in conductor lines. These stress gradients are known to drive mass transport which leads to void formation. Equations are presented which describes the growth rates of two void morphologies. A definition of failure is made and the time to failure is calculated and the relationship with line width and temperature is given. With properties of aluminum taken from the literature, it will be shown that the calculated failure time is in very good agreement with experimental data. 37 refs., 10 figs.

4932 **(SAND—88-2675C) An optical modulator/switch using the reflection from a translated depletion edge.** Huang, T.C.; Lee, K.W.; Hausken, T.; Dagli, N.; Coldren, L.A.; Myers, D. (Sandia National Labs., Albuquerque, NM (USA); California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering). 1989. Contract AC04-76DP00789. 5p. (CONF-890226—1). NTIS, PC A02/MF A01. Order Number DE89001380/JAW.

From Conference on integrated and guided-wave optics; Houston, TX, USA (6 Feb 1989).

An optical waveguide modulator/switch using the impedance discontinuity at a p-n junction across the guide has been demonstrated. From the calculated results, a high speed, small size, single mode modulator/switch is expected. A device with a y-branch was made and the on-off ratio in both the straight through guide and the reflection guide is more than 2:1 for a 1.15μm lightwave. 7 refs., 3 figs.

4933 **Investigation of collisional effects in the plasma erosion opening switch.** Grossmann, J.M.; Kulsrud, R.; Neri, J.M.; Ottinger, P.F. (Naval Research Laboratory, Washington, DC 20375-5000). *Journal of Applied Physics;* **64**: No. 12, 6646-6653(15 Dec 1988).

During the conduction phase of the plasma erosion opening switch (PEOS), magnetic field has been observed experimentally to penetrate completely through plasmas up to 30 cm long. Current channels in the main body of the plasma have been observed that are more than 10 cm (or more than about 60 collisionless skin depths) wide. In addition, the maximum current carried by the switch before opening (the conduction current) seems to scale roughly linearly with plasma density n and switch length l. Collisionless p-smcapsIc-smcaps code simulations of the plasma switch show current conducted in skin-depth-like channels, with the conduction current scaling close to l /sup 2/5/ and n/sup 1/4/. In this paper, the effect of collisions on the behavior of the PEOS is investigated and is shown to bring the p-smcapsIc-smcaps simulations and experimental results in closer agreement. In collisional simulations, current channels as wide as those in experiments are observed, and the conduction current scales linearly with l and as n/sup 1/2/ in the anode-dominated case. In the cathode-dominated case, linear scaling with both length and density can be inferred from the cathode penetration distance versus time.

4934 **Low-energy proton detection by Pd metal-insulator-semiconductor diodes.** Hughes, R.C.; Bastasz, R. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **64**: No. 12, 6839-6844(15 Dec 1988).

It has been discovered that palladium-gated metal-insulator-silicon Schottky barrier diodes are very sensitive to fluxes of energetic protons in high vacuum. Data on the dosimetric response of the diodes to energetic protons are presented, along with data on the subsequent decay in the induced signal. A model for the response is developed, based on the response of similar structures to partial pressures of molecular hydrogen. The model involves adsorption sites at both the external Pd surface and the interface between Pd and SiO_2, as well as known H absorption properties of bulk Pd. The sensitivity at 300 K of our diodes is about 10^9 protons (10/sup 11/ cm^{-2}). The inventory of protons stored in the bulk Pd, the surface, and at the interface indicates that the areal site density for the surface and interface is about 10/sup 15/ cm^{-2}.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 4114, 4130, 4403, 4408, 4617, 4618, 4619, 4871, 4872, 5353

4935 **(NP—9770014-Pt.1) Combustion of straw as briquettes in small furnaces (domestic use) and as big bales in furnaces larger than 500 kW power. Final report.** Strehler, A. von; Rogenhofer, H.; Kraus, U.; Hellwig, M.; Schulze Lammers, P. (Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 186p. (In German). NTIS (US Sales Only), PC A22/MF A01. Order Number DE89770014/JAW.

The combustion of briquettes in small furnaces (up to 6 kW) proved to be complicated in technical point of view (combustion quality, work load, control). Tiled stoves with bigger combustion chambers had better results. Boiler for coarse woodchips and woodlogs functioned well when using the bottom burning system and the right dimension to avoid a return combustion in the charging chamber. The density of briquettes had high influence on slag generation (low density gave slag problems). Furnaces with movable grate worked properly, but investment costs are higher; flue gas cleaning (dust) with expensive filters seems to be unavoidable. Many furnaces had been improved technically. The main problem is dust emission, due to the hard regulations most furnaces do not reach the low values necessary. On the other hand are low emissions in SO/sub 2/ and NO/sub x/ when using straw as fuel. When the price of fuel oil is below 0,70 DM/l, there is no economic basis for heat generation out of straw briquettes with prices of 0,20 DM/kg. Big bales are utilized complete or ground in special furnaces of

higher performance. Last years systems with bale grinding improved together with a movable grate. Dust separation is expensive. Economical combustion of big bales is possible with oil prices higher than 0,60 DM/l when having a straw price of 0,10 DM/kg at the place of furnace. (orig.) With 71 figs., 32 tabs.

4936 **(NP—9770015-Pt.2) Combustion of straw as briquettes in small furnaces (domestic use) and as big bales in furnaces larger than 500 kW power. Final report.** Strehler, A. von; Rogenhofer, H.; Kraus, U.; Hellwig, M.; Schulze Lammers, P. (Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1986. 327p. (In German). NTIS (US Sales Only), PC A15. Order Number DE89770015/JAW.

The combustion of briquettes in small furnaces (up to 6 kW) proved to be complicated in technical point of view (combustion quality, work load, control). Tiled stoves with bigger combustion chambers had better results. Boiler for coarse woodchips and woodlogs functioned well when using the bottom burning system and the right dimension to avoid a return combustion in the charging chamber. The density of briquettes had high influence on slag generation (low density gave slag problems). Furnaces with movable grate worked properly, but investment costs are higher; flue gas cleaning (dust) with expensive filters seems to be unavoidable. Many furnaces had been improved technically. The main problem is dust emission, due to the hard regulations most furnaces do not reach the low values necessary. On the other hand are low emissions in SO/sub 2/ and NO/sub x/ when using straw as fuel. When the price of fuel oil is below 0,70 DM/1, there is no economic basis for heat generation out of straw briquettes with prices of 0,20 DM/kg. Big bales are utilized complete or ground in special furnaces of higher performance. Last years systems with bale grinding improved together with a movable grate. Dust separation is expensive. Economical combustion of big bales is possible with oil prices higher than 0,60 DM/1 when having a straw price of 0,10 DM/kg at the place of furnace. (orig.) With 71 figs., 32 tabs.

4937 **(PB—88-243456/XAB) IEA working party on conservation in combustion. Contributions from 1982 to 1987.** Hustad, J.E.; Soenju, O.K. (Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)). May 1988. 63p. (STF—15-A88014). NTIS, PC E04/MF E04.

The report represents the summary of contributions to the IEA working party on Conservation in Combustion from 1982 to 1987, except for the year 1985.

4220 Underground Engineering

4938 **(AU—U-80-3) Support design for underground cavities in weak rock. Part 2.** Kaiser, P.K.; Maloney, S.; Morgenstern, N.R. (Alberta Univ., Edmonton (Canada)). 1982. 159p. (CE—02011). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report presents the results of research on numerical modeling to evaluate the time-independent behavior of the small tunnels and the interpretation of the time-dependent performance of the tunnels during and after tunnel advance. A study is made of whether the behavior observed during the test corresponds with the real behavior of a tunnel excavated under a preexisting stress field. It was found that the influence of the loading sequence can be explained rationally and that the effects of sample compressibility do not in general dominate the tunnel response except after relatively large time intervals. The radial strain pattern may, however, be affected significantly. The tunnel closure and radial strain distribution were compared to results from finite element analyses. During this investigation various models were assumed. It was found that none of these models describes accurately the stress redistribution processes that occur near the opening due to softening and weakening or yielding of the rock mass. The time-dependent response to external loading and during excavation was evaluated by separating the influence of face advance, yield zone propagation and rock mass creep. The results from this investigation show it was possible to reach good agreement with the models used for the interpretation. Furthermore, critical tunnel closure rates were determined that allowed the prediction of the initiation of tunnel instability. If these observations can be extended to field conditions, it will be possible to improve underground safety by monitoring the opening convergence and by comparison with the critical convergence rate. The practical implications are discussed in detail. 17 refs., 8 figs., 8 tabs.

4939 **(AU/CE—8109) Support design for underground cavities in weak rock. Part 1.** Kaiser, P.K.; Maloney, S.; Morgenstern, N.R. (Alberta Univ., Edmonton (Canada). Dept. of Civil Engineering). Sep 1981. 105p. (CE—01999). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

Because of the importance of time-dependent deformations in the design of underground support systems and the evaluation of the stability of the opening, a research program was initiated to investigate the relative importance of these processes. This report describes the test system, the data processing and presentation, and the material used to represent a rock mass with time-dependent strength and deformation properties. New equipment to test small tunnels during the excavation process is also described. The sampling procedure, sample preparation and instrumentation of this naturally discontinuous medium are detailed. A comparison of the applied loading history with the loading history actually encountered during tunneling is presented. The load level for testing was selected to represent the conditions of a tunnel at large depth or in weak rock. This report further includes a detailed description of typical test results and a discussion of the time-dependent processes, such as failure propagation and associated stress redistribution near tunnels. Both the tunnel convergence and radial strain pattern inside the rock mass are presented in plots of field stress, strain or tunnel closure with time, and strain rate or tunnel closure rate. The tunnel performance in the pre-failure stress range, during the transition to an unstable opening and after a yield zone is developed, is evaluated. Several important conclusions have been drawn with respect to time-dependent processes controlling tunnel convergence, observation of the rock mass response to local yielding, position and type of instrumentation, and propagation of instabilities in overstressed rock. 16 refs., 39 figs.

4940 **(EMR/MR—ERP/MRP/MRL81-37) Mining Research Laboratories annual progress report, 1980/81. Part 1. Research activities.** Scott, J. (comp.). (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Mining Research Labs.). 1981. 46p. (CE—02012). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Mining Research Laboratories consist of three laboratories in Ottawa and two field units in Ontario and Alberta, conducting research, development, and certification activities. This report presents a summary of these activities in the areas of uranium reserves and production, oil sands minings, strata mechanics, underground and surface mining technology, equipment safety certification and research/development, underground environment research, coal oil and coal-water slurries, underground nuclear waste disposal, containment or disposal of mine/mill tailings, authorization and testing of explosives, and explosives research and development.

4941 **(EMR/MR—ERP/MRP/MRL81-40) Mining Research Laboratories annual progress report, 1980/81. Part 2. Administration services.** Scott, J.; Tupper, E.C. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario. Mining Research Labs.). 1981. 118p. (CE—02013). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The Mining Research Laboratories consist of three laboratories in Ottawa and two field units in Ontario and Alberta, conducting research, development, and certification activities. This report presents a brief summary of the administrative services highlights for the year. Also included are a list of reports, external publications and papers presented at conferences. 3 figs., 2 tabs.

4230 Marine Engineering

REFER ALSO TO CITATION(S) 4157, 4158

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 4116

4942 (KFK-PEF—35-Vol.2, pp 681-694) **Pulsed electrostatic precipitators with improved efficiency.** Hinderer, A.; Schwab, A. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Hochspannungsinstitut). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Precipitation efficiency of dc-supplied electrostatic precipitators is limited by back corona, i.e. flyback of particles into the main gas stream. One criterium for the occurence of back corona is the corona current density which, in general, is related to the elctrostatic field intensity. Previously obtained results with pulsed precipitators indicate that, within certain limits, the current density and the field intensity can be decoupled by proper choice of repetition rate and duty cycle. Further a network model for pulsed precipitators and various modulator concepts are presented.

4250 Power Cycles

REFER ALSO TO CITATION(S) 4242

4943 **(DOE/NASA—0371-1) 25 kWe solar thermal stirling hydraulic engine system: Final conceptual design report.** (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Stirling Technology Co., Richland, WA (USA)). Jan 1988. Contract AT04-85AL33408. 240p. (NASA-CR—180889). NTIS, PC A11. Order Number DE89003777/JAW.

This report documents the conceptual design and analysis of a solar thermal free-piston Stirling hydraulic engine system designed to deliver 25 kWe when coupled to the 11-meter Test Bed Concentrator at Sandia National Laboratories. A manufacturing cost assessment for 10,000 units per year was made by Pioneer Engineering and Manufacturing. The design meets all program objectives including a 60,000-hr design life, dynamic balancing, fully automated control, >33.3% overall system efficiency, properly conditioned power, maximum utilization of annualized insolation, and projected production costs of $300/kW. The system incorporates a simple, rugged, reliable pool boiler reflux heat pipe to transfer heat from the solar receiver to the Stirling engine. The free-piston engine produces high-pressure hydraulic flow which powers a commercial hydraulic motor that, in turn, drives a commercial rotary induction generator. The Stirling hydraulic engine uses hermetic bellows seals to separate helium working gas from hydraulic fluid which provides hydrodynamic lubrication to all moving parts. Maximum utilization of highly refined, field proven commercial components for electric power generation minimizes development cost and risk. The engine design is based on a highly refined Stirling hydraulic engine developed over 20 years as a fully implantable artificial heart power source. 4 refs., 19 figs., 3 tabs.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 4916, 4955, 5612

4944 **(CERN-EP—88-85) A flavour factory and nuclear physics facility based on superconducting linacs.** Amaldi, U.; Bassetti, M.; Biscari, C.; Bisognano, J.; Boni, R.; Campisi, I.E.; Castellano, M.; Cavallo, N.; Coignet, G.; Fiander, D.C. (European Organization for Nuclear Research, Geneva (Switzerland)). 15 Jul 1988. 3p. (CONF-880695—68). NTIS (US Sales Only), PC A02. Order Number DE89003195/JAW.

From 1. European particle accelerator conference; Rome, Italy (7 Jun 1988).

In December 1987 a Workshop was held in Courmayeur (Italy) on 'Heavy-Quark Factory and Nuclear-Physics Facility with Superconducting Linacs'. In this paper we summarized and update the main machine points discussed in detail in the Proceedings of the workshop. The 'SC radiofrequency complex' is a recirculated superconducting electron and positron linac which serves as a b{bar b} factory and a high-duty cycle nuclear physics facility. It can provide electron-positron collisions in the c.m. energy range 10 ≦ W ≦ 20 GeV with luminosities L ≦ 10^{34} cm/sup {minus}2/ s/sup {minus}1/ and, at the same time, high intensity and large duty cycle electron beams for nuclear physics experiments up to about 10 GeV. The scheme consists of two racetrack linacs, each one being similar to the CEBAF design. It offers also the possibility of producing c{bar c} (quarks) for 3 ≦ W ≦ 4 GeV with L > 10^{32} cm/sup {minus}2/ s/sup {minus}1/ and of colliding 2.5 GeV positrons (extracted from the damping ring) with 11.2 GeV electrons, so as to produce moving Y(4S) states and have an easier access to the study of CP violation. For nuclear physics the CW beam has a current ≦200 μA and a duty cycle ≧80%. 12 refs., 3 figs., 1 tab.

4945 **(DOE/FTR—9003590) [Attend the CERN accelerator school on advanced accelerator theory, W. Berlin, and visit to CERN, September 12--26, 1987]: Foreign trip report.** Dell, G.F. (Brookhaven National Lab., Upton, NY (USA)). 12 Oct 1987. Contract AC02-76CH00016. 13p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003590/JAW.

The traveler attended the CERN Accelerator School on advanced accelerator physics that was held at the Johannesstift in W. Berlin Sept. 14-25, 1987. Formal lectures were delivered on advanced accelerator physics. These included lectures on Hamiltonian dynamics as well as lectures on stocastic cooling, Landau damping, Schottky noise, nonlinear resonances, and bunched beam coherent instabilities. These latter lectures are based on experience gained from CERN colliders and are subjects pertinent to the operation of RHIC. A one day visit to CERN was made on the return trip to the US; the primary goal was to search through the informal reports on accelerator physics generated by the LEP (Large Electron Positron Collider) group and obtain copies of those reports of interest for RHIC design.

4946 (INIS-SU—58, pp 57-60) **NGM-16 neutron generator.** Kir'yanov, G.I.; Malinin, Yu.N.; Sil'nikov, E.S.; Smitskoj, E.P.; Syromukov, S.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

The NGM-16 neutron generator providing neutron flux under continuous mode up to 2x10/sup 11/ c/sup -1/ is considered. The characteristic property of the generator is the fact that the high frequency generator (HFG) providing a plasma high-frequency discharge in a ion-source flask is placed on the control board at the zero potential. Such arrangement of HFG permits to increase its power without increasing radiation source overall dimensions. The NGM-16 neutron generator provides constant and modulated neutron flux. Pulse duration can change from 10 to 10/sup 6/ μs, the frequency of pulse recurrence - from 1 to 5 x 10/sup 4/ HzW. 6 refs.; 5 figs.

4947 (LBL—25778) The Advanced Light Source at Lawrence Berkeley Laboratory. Cornacchia, M. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 17p. (CONF-8808141—7). NTIS, PC A03/MF A01. Order Number DE89002914/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

The Advanced Light Source is a national user facility for the production of high brightness and partially coherent X-ray and ultraviolet synchrotron radiation, which is now under construction at Lawrence Berkeley Laboratory. The facility is based on a low emittance electron storage ring, photon beamlines and user support facilities. The lattice optics is optimized for undulator operation and can accommodate up to 11 insertion devices in the straight sections and up to 48 ports in the bending magnets. The nominal electron energy is 1.5 GeV, the horizontal emittance 10^{-8} m rad, the circulating current 400 mA in the multibunch mode of operation. The parameters are chosen to cover the photon spectrum from about 5 eV to 1 keV with undulators and up to 10 keV with wigglers. The choice of energy is dictated by the need to cover the above photon energy range with an undulator gap not smaller than 1.4 cm. The facility is now in its second year of construction and is planned to be completed in late 1992 at a total cost of $98.7 million. 4 refs., 8 figs., 1 tab.

4948 (LBL—25921) Future directions in high energy electron-positron experimentation. Trilling, G.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 19p. (CONF-8806260—2). NTIS, PC A03/MF A01. Order Number DE89002917/JAW.

From 19. international symposium on multiparticle dynamics - new data and theoretical trends; Arles, France (13 Jun 1988).

In this report, the possibilities of studying particle physics at the TeV scale with high energy electron-positron linear colliders are discussed. A status report on the SLC and the MARK II program is given to provide some insights on the feasibility of experiments at linear colliders. The technical issues in going from SLC to the development of TeV colliders are briefly discussed. Some of the elements of the e^+e^- experimental environment which differentiate it from that in hadron colliders and give examples of processes particularly well suited to attack by e^+e^- annihilation are summarized. Finally, some concluding remarks are given. 8 refs., 10 figs., 2 tabs.

4949 (SLAC-PUB—4769) SLAC R and D toward a TeV Linear Collider. Wilson, P.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 7p. (CONF-881049—34). NTIS, PC A02/MF A01. Order Number DE89002835/JAW.

From Linear accelerator conference; Williamsburg, VA, USA (3 Oct 1988).

At CERN, KEK, Novosibirsk and SLAC, serious thought is being given to the design of linear colliders in the 0.5--2.0 TeV center-of-mass energy range. This paper reviews current progress at SLAC toward the design of such a collider. No attempt is made here to summarize ongoing work at the other laboratories. However, research on linear colliders is clearly an international effort, and success at SLAC will be greatly expedited by communication and cooperation with other laboratories in the US and abroad. In addition to major programs at the laboratories mentioned above, contributions relevant to linear collider design are being made at DESY, LAL (Orsay), LBL, LLNL and elsewhere. 49 refs., 6 tabs.

4950 (SLAC-PUB—4770) Linear collider research and development at SLAC, LBL and LLNL. Mattison, T.S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 8p. (CONF-880867—14). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003782/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

The study of electron-positron (e{sup +}e/sup {minus}/) annihilation in storage ring colliders has been very fruitful. It is by now well understood that the optimized cost and size of e{sup +}e/sup {minus}/ storage rings scales as E(sub cm){sup 2} due to the need to replace energy lost to synchrotron radiation in the ring bending magnets. Linear colliders, using the beams from linear accelerators, evade this scaling law. The study of e{sup +}e{sup {minus}} collisions at TeV energy will require linear colliders. The luminosity requirements for a TeV linear collider are set by the physics. Advanced accelerator research and development at SLAC is focused toward a TeV Linear Collider (TLC) of 0.5--1 TeV in the center of mass, with a luminosity of 10{sup 33}--10{sup 34}. The goal is a design for two linacs of less than 3 km each, and requiring less than 100 MW of power each. With a 1 km final focus, the TLC could be fit on Stanford University land (although not entirely within the present SLAC site). The emphasis is on technologies feasible for a proposal to be framed in 1992. Linear collider development work is progressing on three fronts: delivering electrical energy to a beam, delivering a focused high quality beam, and system optimization. Sources of high peak microwave radio frequency (RF) power to drive the high gradient linacs are being developed in collaboration with Lawrence Berkeley Laboratory (LBL) and Lawrence Livermore National Laboratory (LLNL). Beam generation, beam dynamics and final focus work has been done at SLAC and in collaboration with KEK. Both the accelerator physics and the utilization of TeV linear colliders were topics at the 1988 Snowmass Summer Study. 14 refs., 4 figs., 1 tab.

4951 Quantum beamstrahlung: Prospects for a photon-photon collider. Blankenbecler, R.; Drell, S.D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309). *Physical Review Letters;* **61**: No. 20, 2324-2327(14 Nov 1988).

In this paper the treatment of radiation in pulse-pulse collisions relevant to high-energy electron-positron colliders is extended to multiple-photon processes. The resultant multiple-photon spectrum is hard. We discuss the possibility of a photon-photon collider utilizing this radiation. The expected flux is calculated and turns out to be from 1 to 2 orders of magnitude larger than that of the conventional virtual-two-photon source, depending upon machine parameters. Photon-electron processes are also enhanced by this additional hard-photon source.

4302 Beam Dynamics, Field Calculations, And Ion Optics

4952 (BNL—41668) MINI-β insertion and luminosity for the RHIC lattice. Lee, S.Y. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 8p. (CONF-880335—22). NTIS, PC A02/MF A01. Order Number DE88016583/JAW.

From Workshop on the relativistic heavy ion collider performance; Upton, NY, USA (21 Mar 1988).

Requirement and implication of the mini-β insertion in RHIC lattice is studied. For the heavy ion operation, we find that: When the gradient is maintained at 67T/m, the free space for the experimental setup becomes +-4m at $\beta^* = 1.5$m with maximum crossing angle of 3mrad at 100 GeV/amu. To maintain a minimum of +-5m free space for experimental setup, a higher gradient is needed. At 84.5T/m gradient, $\beta^* = 1$m can be achieved. In this case, the beam size limitation is located at BC2, where 10cm coil i.d. is designed. When the machine is operating at the proton-heavy ion interaction mode, these common quadrupoles should be removed physically in order to let both beams crossing the center line at 3.5mrad. These mini-β insertion can increase the luminosity by a factor of 2.3. For the proton operational mode, we find that $\beta^* = 1$m, which corresponds to $\beta = 1200$m is also operable without the mini-β quadrupoles. When the mini-β quads are used, $\beta^* = 0.25$ can be achieved. 1 ref., 3 tabs.

4953 (BNL—41998) Snake resonances. Tepikian, S. (Brookhaven National Lab., Upton, NY (USA)). [1988]. Contract AC02-76CH00016. 11p. (CONF-880983—14). NTIS, PC A02. Order Number DE89003161/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Siberian Snakes provide a practical means of obtaining polarized proton beams in large accelerators. The effect of snakes can be understood by studying the dynamics of spin precession in an accelerator with snakes and a single spin resonance. This leads to a new class of energy independent spin depolarizing resonances, called

snake resonances. In designing a large accelerator with snakes to preserve the spin polarization, there is an added constraint on the choice of the vertical betatron tune due to the snake resonances. 11 refs., 4 figs.

4954 **(DOE/ER/40374—8) Beam-beam interaction and Pacman effects in the SSC with random nonlinear multipoles.** Goderre, G.P.; Ohnuma, S. (Houston Univ., TX (USA)). 1988. Contract FG05-87ER40374. 58p. (UH-IBPD—001-88(1988)). NTIS, PC A04/MF A01. Order Number DE89003356/JAW.

In order to find the combined effects of beam-beam interaction (head-on and long-range) and random nonlinear multipoles in dipole magnets, transverse tunes and smears have been calculated as a function of oscillation amplitudes. Two types of particles, "regular" and "Pacman," have been investigated using a modified version of tracking code TEAPOT. Regular particles experience beam-beam interactions in all four interaction regions (IR's), both head-on and long range, while pacman particles interact with bunches of the other beam in one medium-beta and one low-beta IR's only. The model for the beam-beam interaction is of weak-strong type and the strong beam is assumed to have a round Gaussian charge distribution. Furthermore, it is assumed that the vertical closed orbit deviation arising from the finite crossing angle of 70 μrad is perfectly compensated for regular particles. The same compensation applied to pacman particles creates a closed orbit distortion. Linear tunes are adjusted for regular particles to the design values but there are no nonlinear corrections except for chromaticity correcting sextupoles in two families. Results obtained in this study do not show any reduction of dynamic or linear aperture for pacman particles but some doubts exist regarding the validity of defining the linear aperture from the smear alone. Preliminary results are given for regular particles when (Δp/p) is modulated by the synchrotron oscillation. For these, fifty oscillations corresponding to 26,350 revolutions have been tracked. A very slow increase in the horizontal amplitude, {approximately}4 {times} 10/sup {minus}4//oscillation (relative), is a possibility but this should be confirmed by trackings of larger number of revolutions. 11 refs., 18 figs., 2 tabs.

4955 **(DOE/ER/40374—10) Research in accelerator physics (theory): Technical report, August 15, 1987--May 14, 1988.** Ohnuma, Shoroku. (Houston Univ., TX (USA)). Aug 1988. Contract FG05-87ER40374. 8p. NTIS, PC A02/MF A01. Order Number DE89003355/JAW.

This report briefly discusses the following topics on accelerator physics: breakup of KAM tori in Hamiltonian systems with three degrees of freedom; period m-typing in Hamiltonian systems with two degrees of freedom; beam-beam interaction and pacman effect; correction schemes of nonlinear effects; systematic treatment of isolated nonlinear resonances; optimization of linac injection system; and luminosity lifetime in the Tevatron. (LSP)

4956 **(GSI—88-49(prepr.)) Heavy-ion cooling and radiative recombination.** Beyer, H.F. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Sep 1988. 19p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755949/JAW.

There is presently a large number of ion storage rings under construction which will use electron cooling for increasing the phase-space density of the stored ions in order to gain luminosity and resolution advantages for a variety of experiments. In this review a more general introduction to the electron-cooling technique is given. The atomic-physics aspects of electron-ion interactions at low relative velocity are identified. One of the most important processes is electron-ion radiative recombination because it can have strong implications on the operation of a storage ring employing electron cooling. Estimates are given of the ion-beam lifetime, as limited by recombination losses, as a function of electron density and temperature and for all values of the atomic number Z of the ions. The use of recombination processes in the electron cooler for atomic spectroscopy of few-electron heavy ions is discussed along with their implication on diagnostics of electron cooling.

4957 (INIS-SU—62/A, pp 201-205) **Feasibilities of obtaining high energy polarized hadron beams.** Nurushev, S.B.; Rzaev, R.A.; Sakharov, V.P. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The successful realization of an intense programme of polarization researches is greatly dependent on the availability of various rich polarized particle beams, primarily proton ones. A number of possibilities and ways of obtaining high-energy polarized hadron beams off the internal target is discussed. Their parameters are estimated in terms of the U-70 and UNK energy range. The method of obtaining polarized proton (antiproton) beams from ΛΛbar)-hyperon decay is described. Proton polarization at elastic scattering is obtained. Possibilities to obtain polarized neutron beams are discussed too. 10 refs.; 2 figs.

4958 (INIS-SU—62/A, pp 206-209) **Correcting the AGS depolarizing resonances.** Lazarus, G.; Ratner, G. (Brookhaven National Lab., Upton, NY (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

To achieving a 22 GeV/c polarized beam at the Brookhaven AGS works on correcting the AGS depolarizing resonances are reported. The necessity of correcting an imperfection resonance using a "beat" harmonic instead of the direct harmonic is shown. 4 refs.; 5 figs.

4959 (INIS-SU—62/A, pp 215-218) **Acceleration of polarized deuterons at the synchrophasotron.** Belushkina, A.A.; Beznogikh, Yu.D.; Ershov, V.P. and others. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Principle of operation of the cryogenic atomic beam source POLARIS of polarized deuterons designed for research in the field of nuclear physics is described. Results of measurements of deuteron polarization is given. Vector and tensor polarizations are as follows P/sub Z/=0.5, P/sub ZZ/=0.5-0.7. The beam of 10 GeV polarized deuterons is ejected from the synchrophasotron. The beam intensity equals 5x10/sup 8/ deuterons/pulse. 7 refs.; 2 figs.

4960 (INIS-SU—62/A, pp 219-220) **Polarization of electrons in an electromagnetic wave and a magnetic field.** Melikyan, R.A. (Erevanskij Fizicheskij Inst. (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The possibility of rapid polarization of electrons in the field of circularly-polarized wave propagating along the direction of a constant homogeneous magnetic field is considered for small transverse and large longitudinal momenta of electrons. 1 ref.

4961 **(ITEF—202(1987)) GERA-3L program packet for solution of electrostatics three-dimensional boundary value problems.** Khapalov, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704362/JAW.

The GERA-3L program packet for numerical solution of three-dimensional boundary problems of electrostatics in restricted regions of practically arbitrary shape both with monobound and multibound piecewise-smooth boundaries is described. Special attention was paid to the problems of netting generation automation, convenience and simplicity of work with input data, economic method of linear equation system solution and visualization of the output data. The method of finite elements is put in the basis of the calculated region quantization. Analytical part of the packet is real-

ized on the basis of linear algebra program complex, which permits to solve the system of linear equations of the order 10000 and a more direct method using the external storage. The program is written in the Fortran 4-OE and PL/I languages and is adapted in the framework of OS ES. In the process of packet testing a number of calculations of various structures was made, in particular, of accelerating-focusing channel with asymmetric phase-alternating focusing and accelerating-focusing channel with spatial-homogeneous quadrupole focusing. 11 refs.; 10 figs.

4962 **(SAND—87-2015) Analysis and benchmarking calculations for the BUCKSHOT code.** Shokair, I.R.; Wagner, J.S. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01. Order Number DE89002997/JAW.

The BUCKSHOT code is tested and benchmarked. The equations of motion solved by BUCKSHOT are analyzed and solutions for single particle orbits are compared with exact solutions for a single electron propagating in an ion channel and an electron in an external magnetic field. A closed form solution of the linearized rigid ion hose equations is derived and compared with solutions obtained by BUCKSHOT for square beam/channel profiles. Excellent agreement is obtained for early times and for small axial positions, before profile changes become large. As the beam and channel profiles change, BUCKSHOT shows a slightly larger growth rate followed by phase-mix damping. Finally, the effect of noise on growth of the ion hose instability is considered. It is found that noise has no effect on the hose growth in the first few betatron wavelengths of propagation, but the effect of phase-mixing is suppressed by the noise at longer propagation distances. 6 refs., 15 figs.

4963 **(SLAC—331) EGUN: An electron optics and gun design program.** Herrmannsfeldt, W.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 67p. NTIS, PC A04/MF A01 - OSTI. Order Number DE89002741/JAW.

The name EGUN has become commonly associated with the program also known as the SLAC Electron Trajectory Program. This document is an updated version of SLAC-226, published in 1979. The program itself has had substantial upgrading since then, but only a few new features are of much concern to the user. Most of the improvements are internal and are intended to improve speed or accuracy. EGUN is designed to compute trajectories of charged particles in electrostatic and magnetostatic fields, including the effects of space charge and self-magnetic fields. Starting options include Child's Law conditions on cathodes of various shapes, as well as used specified initial conditions. Either rectangular or cylindrical symmetry may be used. In the new jargon, the program is a 2-1/2 dimension code meaning 2-D in all fields and 3-D in all particle motion. A Poisson's Equation Solver is used to find the electrostatic fields by using difference equations derived from the boundary conditions. Magnetic fields are to be specified externally, by the user, by using one of several methods including data from another program or arbitrary configurations of coils. This edition of the documentation also covers the program EGN87c, which is a recently developed version of EGUN designed to be used on the newer models of personal computers, small main frames, work stations, etc. The EGN87c program uses the programming language C which is very transportable so the program should operate on any system that supports C. Plotting routines for most common PC monitors are included, and the capability to make hard copy plots on dot-matrix printer-plotters is provided. 18 refs., 7 figs.

4964 **(SLAC-PUB—4764) Polarization at the SLC.** Moffeit, K.C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 18p. (CONF-880983—16). NTIS, PC A02. Order Number DE89003783/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

The Stanford Linear collider was designed to accommodate polarized electron beams. Longitudinally polarized electrons colliding with unpolarized positrons at a center of mass energy near the Z^0 mass can be used as novel and sensitive probes of the electroweak process. A gallium arsenide based photon emission source will provide a beam of longitudinally polarized electrons of about 45 percent polarization. A system of bend magnets and a superconducting solenoid will be used to rotate the spins so that the polarization is preserved while the 1.21 GeV electrons are stored in the damping ring. Another set of bend magnets and two superconducting solenoids orient the spin vectors so that longitudinal polarization of the electrons is achieved at the collision point with the unpolarized positrons. A system to monitor the polarization based on Moller and Compton scattering will be used. Nearly all major components have been fabricated and tested. Subsystems of the source and polarimeters have been installed, and studies are in progress. The installation and commissioning of the entire system will take place during available machine shutdown periods as the commissioning of SLC progresses. 8 refs., 16 figs., 1 tab.

4965 **(UCRL—99929) FY 88 laser transport experiments on ATA [Advanced Test Accelerator].** Chambers, F.W.; Boyd, J.K.; Caporaso, G.J.; Chong, Y.P.; Fawley, W.M.; Hildum, J.S.; Lee, P.; Orzechowski, T.J; Prono, D.S.; Smith, A.C. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1988. Contract W-7405-ENG-48. 8p. (CONF-8809149—25). NTIS, PC A02/MF A01. Order Number DE89003270/JAW.

From DARPA/SDIO services annual propagation review; Newport, RI, USA (12 Sep 1988).

An experiment was conducted at the Advanced Test Accelerator (ATA) in the spring/summer of 1988 to study the transport of the "laser guided" electron beam through the accelerator and beyond. The electron beam was guided from the {approximately}3.75 MeV point through the accelerator on an ion channel created by firing a KrF laser (248 nm, P ~100--400 mJ) into a benzene filled (p ~.1 μ) beamline. Beam transport was documented at several locations with a variety of diagnostics for various beam parameters; channel, gas, and laser parameters; and for various machine configurations. The focus of this experiment was to document, understand, and then alter (remove) the time variation in the observed accelerated beam parameters. The temporal variation of the beam manifests itself in several ways as has been documented. Beam radius versus time, R(t), from both bow probe and optical data shows the beam radius expanding by factors of up to several over the 40 ns of beam pulse. When the beam is threaded through any device with a limited acceptance the radius variation is parlayed into a current variation, I(t). This has been documented for transport through the fusible link, rise time sharpener, slits, bends, emittance selectors, and during free expansion. The beam temporal variation in time may be viewed as radius increase or blowup, brightness degradation, or emittance increase. The observations of blowup predate the introduction of the collimator. The observations prior to this experiment were made in the post accelerator transport sections. 9 refs., 4 figs.

4966 **Laser wakefield acceleration and relativstic optical guiding.** Sprangle, P.; Joyce, G.; Esarey, E.; Ting, A. (Naval Research Laboratory, Washington, DC 20375—5000). *AIP (American Institute of Physics) Conference Proceedings;* **175**: No. 1, 231-242(10 Nov 1988). (CONF-8803133—).

From Nonnetral plasma physics; Washington, DC, USA (28 Mar 1988).

An electron acceleration method is investigated which employs a short (tau/sub L/~2πω/sub p//sup -1/~ picosec), high power (P≧10^5 W), single frequency laser pulse to generate large amplitude (E≧1 GeV/m) plasma waves (wakefields). At sufficiently high laser power (P≧17(ω/ω/sub p/)^2 GW), relativistic optical guiding may used be to prevent the pulse from diffracting within the plasma.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 4959, 5449

4967 (ACIESP—60-Vol.4, pp 52-58) **Main applications of accelerators, reactor and irradiation sources cyclotron.** Lucki, G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The specifications of CV-28 cyclotron from IPEN/CNEN/SP are presented. (E.G.).

4968 **(BNL—41664) Intrabeam scattering results for a high frequency rf system.** Parzen, G. (Brookhaven National Lab., Upton, NY (USA)). [1988]. Contract AC02-76CH00016. 6p. (CONF-880335—26). NTIS, PC A02/MF A01. Order Number DE88016587/JAW.

From Workshop on the relativistic heavy ion collider performance; Upton, NY, USA (21 Mar 1988).

The rf system being proposed has the harmonic number h = 8 {times} 342 = 2736, corresponding to a frequency of about f = 214 MHz. It was found that this rf system requires a voltage larger than 32 MV in order for the rf bucket to be large enough to contain the energy spread for a beam of gold ions, after 10 hours, at γ = 100 with N/sub b/ = 1.1 {times} 10^9 ions/bunch, and an initial bunch area A = 1 eV-sec/amu. This paper discusses this rf system influence on beam scattering. 2 figs.

4969 **(BNL—41847) Data acquisition for RHIC report of the working group.** Atiya, M.; Gibbard, B.; Hackenburg, R.; LeVine, M.; Throwe, T.; Watson, W.; Cole, J.D.; Drigert, M.; Huang, H.; Juricic, I. (Brookhaven National Lab., Upton, NY (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1988. Contract AC02-76CH00016;AC07-76ID01570. 8p. (CONF-880762—2). NTIS, PC A02/MF A01. Order Number DE89003158/JAW.

From Summer institute: school and workshop on heavy ion physics; Upton, NY, USA (11 Jul 1988).

As experimental configurations for RHIC become better defined, the requirements for data acquisition for each of the evolving experiments becomes susceptible to detailed analysis. An earlier contribution made it clear that the scale of these experiments makes demands on data acquisition that are at least as severe as some of the large-scale collider experiments being mounted at Fermilab and LEP. In this report, we attempt to answer the following questions: what sort of performance is required by each of the experiments; is there a single architecture flexible enough to accommodate all of the proposed experiments; what are the costs associated with such a implementation; and how far in advance of beam does a data acquisition implementation need to be started? 3 refs., 2 figs., 1 tab.

4970 **(CONF-881151—36) A high brightness plasma sputter heavy negative ion source.** Alton, G.D.; Mori, Y.; Takagi, A.; Ueno, A.; Fukumoto, S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01. Order Number DE89003107/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A high-intensity, pulsed-mode, plasma-sputter heavy negative ion source has been developed; this source holds promise for a number of uses, including tandem electrostatic accelerator/synchrotron injection applications. To date, the source has been used to generate mA intensities from more than 18 sputter probes. A brief description of the source and typical performance data for a number of ion species are given. In addition, basic ion source operational data, such as intensity versus cesium oven temperature, sputter probe voltage, and discharge pressure, along with emittance data, are presented. 12 refs., 11 figs., 2 tabs.

4971 **(FNAL-TM—1548) Energy deposition in TEVATRON magnets from beam losses in interaction regions.** Ginneken, A.V. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1988. Contract AC02-76CH03000. 14p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004003/JAW.

In addition to interacting in the detector, particles produced at an interaction region also deposit energy, with less desirable consequences, in magnets and other components of the accelerator. This note briefly assesses the damage potential of these (essentially unavoidable) beam losses from the viewpoint of quenching of superconducting magnets in an upgraded Tevatron, specifically for the 1 TeV p-{ovr←string}p option with a luminosity of 10^{31} cm/sup - 2/ sec^{-1}, through the results carry more generality. Related issues such as radiation damage to detector electronics or other components are not addressed here. These are thought to be less problematic at the Tevatron, as in thus far supported by operational experience. 8 refs., 10 figs.

4972 **(GSI—88-37-Prepr.) New heavy-ion facilities and the projectile fragment separator project at GSI.** Armbruster, P.; Geissel, H.; Kienle, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 14p. (CONF-880795—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755570/JAW.

From Tokyo symposium on heavy-ion and nuclear astrophysical problems; Tokyo, Japan (19 Jul 1988).

At CSI heavy-ion research will be extended to relativistic energies with the new synchrotron SIS. All ions up to uranium will be accelerated up to specific energies of 1-2 GeV/u. Secondary beams of radioactive isotopes will be produced with a high rate and efficiently separated by the projectile-fragment separator (PFS), presently under construction. The separated fragments can be investigated at the foci of the separator, or they will be injected into the storage- and cooler-ring ESR for experiments in the ring. Using the cooling facilities of the ESR the phase-space density of the radioactive beam is highly increased, i.e. the momentum spread is reduced to approximately 10/sup -5/ allowing to decelerate down to the Coulomb barrier. This specially prepared beam can be extracted from the ESR and delivered to the different experimental facilities in the main experimental area.

4973 (INIS-SU—58, pp 67-69) **On the boundaries of the 3/2 power law applicability when calculating ion source electrode systems.** Golubkov, E.P.; Latyshev, L.A.; Mileshkin, A.G.; Obukhov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

On the basis of the analytical solution of the self-consistent problem on ion current passing through the accelerating gap emitter - an extending electrode of a plane configuration with regard to initial rates of charged particles, it is shown that the "law of 3/2 degree" with sufficient accuracy ({similar←to}%) describes the pattern of charged particle current passing through the accelerating gap only in case, if the extending electrode potential given V/sub min/ ≧000. For cases, when 250 ≦ <1000, it is suggested a new regularity permitting to analyse the operation of an interelectrode gap with the same accuracy. 1 ref.

4974 (INIS-SU—58, pp 69-71) **Analysis of working processes in lithium ion source with surface ionization on rhenium in the mode of thermal ionization in volume.** Golubkov, E.P.; Latyshev, L.A.; Mileshkin, A.G.; Obukhov, V.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

The theoretical analysis of lithium ionization processes in a ion source and rhenium surface ionization in the mode, being characterized by the fact that the processes of surface ionization on walls and electron emission from ionizer channel walls are combined with the thermal ionization in volume, is carried out. Analytical dependences and illustrating material - the result of calculations of the working process in the source - permitting to determine current characteristics of the source depending on the characteristic ionizer channel sizes, temperature conditions of its operation and the mode of lithium supply to the ionizer are presented. It is shown that the mode of thermal ionization in volume under certain limits of lithium yield through the source can be turned out to be competitive (by the level of values of the ionization degree and current density) with respect to the mode of ion-formation absence in volume. 2 refs.; 5 figs.

4975 (INIS-SU—59/A, pp 82) **Software for the SIBIR-1 installation automated control system.** Katalev, Yu.V.; Lipilin, A.V.; Yupinov, Yu.L. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780006/JAW.

Voprosy atomnoj nauki i tekhniki.; no.4(40).

In General and nuclear physics. Scientific-technical collection.

4976 (INIS-SU—62/A, pp 171-174) **Pulsed high-intensity source of polarized protons.** Belov, A.S.; Esin, S.K.; Kubalov, S.A.; Kuzik, V.E.; Yakushev, V.P. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The description of the pulsed high-intensity source of polarized protons is given. A new type ionizer is employed in the source. The H-vector/sup +/ beam with the peak current of 10 mA is obtained at accelerating voltage of 26 kV. The corresponding deuterium emission beam current density is 420 mA cm/sup -2/. 4 refs.; 2 figs.

4977 (INIS-SU—62/A, pp 180-181) **High density stabilization of nuclear-polarized atomic hydrogen for polarized proton sources.** Mertig, M.; Luppov, V.G.; Pilipenko, Yu.K. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The aim of this work is to calculate the nuclear polarization of hydrogen P=81-a/b)/(1+a/b) under different experimental conditions such as temperature T, density n, magnetic field, adsorption energy of atoms on the walls and the area-to-volume ratio of a cell. The dependence of the nuclear polarization on T and n is shown. These results show that not only optimal temperature conditions are necessary to achieve a high nuclear polarization, but also density increase by means of the compression limits the nuclear polarization. At temperatures of T{similar←to}.2 K nuclear polarization P=99% is attainable up to densities of 10/sup 18/ cm/sup -3/. 3 refs.; 2 figs.

4978 (INIS-SU—62/A, pp 233-235) **Polarized heavy ion sources.** Zaika, N.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Nuclei of atoms can be polarized by following methods: the classical separation of spin components in multipole magnets, Lamb shift method, attachment of polarized electron, optical pumping, orientation of the electron shell by interaction with surface. Schematic representation of these methods is given. Possible properties of polarized ion sources and the state of their development are indicated their development are indicated. 6 refs.; 2 figs.

4979 (INIS-SU—62/A, pp 213-214) **On the possibilities of polarized e/sup +-/ and γ-beam production in the proton accelerators.** Baryshevskii, V.G.; Tikhomirov, V.V. (Belorusskij Gosudarstvennyj Univ., Minsk). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Electron (e/sup -/), positron (e/sup +/) and γ-quantum (γ) beams with energies of an order of tens or hundreds of GeV are produced in proton accelerators. It is shown that the polarization effects accompanying e/sup +-/, γ passage through crystals, allow to make such beams polarized. Thus polarization effects in crystals give possibility to produce beams of e/sup +-/ and γ with the polarization 50-80%, the energies exceeding the energy obtained by e/sup -/ accelerators and intensities one-two orders lower than that non-polarized e/sup +-/ and γ beams produced by proton accelerators. 3 refs.; 3 figs.

4980 (INIS-SU—62/A, pp 224-227) **Polarized /sup 13/C target for intermediate energy hadron scattering experiments.** Penttila, S.I.; Jarmer, J.J. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The plans for developing polarized /sup 13/C targets that will be used for proton and pion scattering experiments at the HRS, EPICS and LEP facilities at LAMPF are discussed. In the proposed experiments a dilution refrigerator is under development; it has been designed to operate with its axis in either the horizontal or vertical position. 9 refs.; 2 figs.

4981 (INIS-SU—62/A, pp 236-237) **Targets with frozen polarization of hydrogen and deuterium nuclei.** Bortsov, N.S.; Bunyatova, E.I.; Kiselev, Yu.P. and others. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

4982 **(LA-UR—88-3954) H/sup {minus}/ injection into the low-energy booster of the SSC.** Colton, E.P.; Thiessen, H.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8806243—5). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003584/JAW.

From DPF summer study: Snowmass '88 on high energy physics in the 1990s; Snowmass, CO, USA (27 Jun 1988).

Protons are accumulated into the low-energy booster of the SSC by utilizing H/sup {minus}/ → H^+ conversion in a 225- μg/cm² carbon stripping foil. Synchronous injection is performed for 26 turns into stationary rf buckets, thereby allowing operation with variable bunch spacing. By injecting the beam offset in x and y we obtain the required rms normalized transverse emittance area of 0.75 π mm-mr. Similarly the required rms longitudinal emittance area of 1.75π {times} 10/sup {minus}3/ eVs is obtained by injecting single linac micropulses, centered at {phi} = 0, and dp/p = +0.12%, into each 49.9-MHz rf bucket formed with an rf voltage of 350 kV. The transverse space-charge tune shift is -0.17 for 10^{10} protons/bunch accumulated at 600 MeV. 1 ref., 5 figs., 1 tab.

4983 **(SLAC-PUB—4647) Rf breakdown studies in room temperature electron linac structures.** Loew, G.A.; Wang, J.W. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). May 1988. Contract AC03-76SF00515. 12p. (CONF-880687—6). NTIS, PC A03. Order Number DE89003787/JAW.

From 13. international symposium on discharges and electrical insulation in vacuum; Paris, France (27 Jun 1988).

This paper is an overall review of studies carried out by the authors and some of their colleagues on RF breakdown, Field Emission and RF processing in room temperature electron linac structure. The motivation behind this work is twofold: in a fundamental way, to contribute to the understanding of the RF breakdown phenomenon, and as an application, to determine the maximum electric field gradient that can be obtained and used safely in future e/sup +-/ linear colliders. Indeed, the next generation of these machines will have to reach into the TeV (10^{12} eV) energy range, and the accelerating gradient will be to be of the crucial parameters affecting their design, construction and cost. For a specified total energy, the gradient sets the accelerator length, and once the RF structure, frequency and pulse repetition rate are selected, it also determines the peak and average power consumption. These three quantities are at the heart of the ultimate realizability and cost of these accelerators. 24 refs., 19 figs., 4 tabs.

4984 **(SLAC-PUB—4737) A CDU-based data acquisition system for the energy spectrometer at the Stanford Linear Collider.** Briggs, D.D.; Tinsman, J.E.; Rouse, F.; von Zanthier, C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515;AC03-76SF00098. 4p. (LBL—26243; CONF-881103—3). NTIS, PC A02/MF A01. Order Number DE89002841/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

We describe a system using the Calorimetry Data Unit (a 32-channel multisample analog integrated circuit) to read out the charge ejected by secondary emission of a synchrotron beam from wires lying in its path. The wires comprise the Wire-Imaging Synchrotron Radiation Detector (WISRD) in the SLC Extraction-Line Spectrometer. The primary module in the system is a board containing 24 channels of charge sensitive amplification, shaping, sampling, multiplexing and digitization. This board also provides a fast analog measure of the charge distribution across the wires. We discuss the design and performance of this system. 4 refs., 5 figs.

4985 **(SLAC-PUB—4758) Gallium arsenide digital integrated circuits for controlling SLAC CW-RF systems.** Ronan, M.T.; Lee, K.L.; Corredoura, P.; Judkins, J.G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA); Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract AC03-76SF00515. 3p. (LBL—26103; CONF-881103—18). NTIS, PC A02 - OSTI. Order Number DE89003784/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

In order to fill the PEP and SPEAR storage rings with beams from the SLC linac and damping rings, precise control of the linac subharmonic buncher and the damping ring RF is required. Recently several companies have developed resettable GaAs master/slave D-type flip-flops which are capable of operating at frequencies of 3 GHz and higher. Using these digital devices as frequency dividers, one can phase shift the SLAC CW-RF systems to optimize the timing for filling the storage rings. We have evaluated the performance of integrated circuits from two vendors for our particular application. Using microstrip circuit techniques, we have built and operated in the accelerator several chassis to synchronize a reset signal from the storage rings to the SLAC 2.856 GHz RF and to phase shift divide-by-four and divide-by-sixteen frequency dividers to the nearest 350 psec bucket required for filling. 4 refs., 4 figs., 2 tabs.

4304 Storage Rings

REFER ALSO TO CITATION(S) 5378

4986 **(DESY—86-170) HERA and polarization at HERA.** Barber, D.P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Dec 1986. 14p. (CONF-8609151—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755564/JAW.

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A report on the status of the HERA project is presented. The machine, the proposed experiments and the plans for longitudinal polarization are described.

4987 **(FNAL/C—88/152) Using the circulating beam in the Fermilab antiproton accumulator for experiments.** MacLachlan, J.A. (Fermi National Accelerator Lab., Batavia, IL (USA)). 15 Aug 1988. Contract AC02-76CH03000. 6p. (CONF-8808145—11). NTIS, PC A02/MF A01. Order Number DE89003240/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

The Fermilab Accumulator is a storage ring optimized for stacking and stochastic cooling 8 GeV antiprotons for the Tevatron collider. Minor modifications have been made to provide for beam in the energy range 8.0-2.9 GeV of luminosity {approximately}10^{31}cm^{-2}s/sup - 1/ with a hydrogen jet internal target. Experience to date consists of machine studies and detector engineering run with protons. 7 refs.

4988 (INIS-mf—11328, pp 84) **P-p-bar program of CERN - status and outlook.** Schindl, K. (European Organization for Nuclear Research, Geneva (Switzerland)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

4989 (INIS-SU—62/A, pp 175-179) **Measurement of colliding beams polarization on the VEPP-2M using helical ondulator.** Vorob'ev, P.V.; Kezerashvili, G.Ya.; Lysenko, A.P.; Polunin, A.A.; Shatunov, Yu.M. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The tehnique and results of measurements of colliding beam polarization in the VEPP-24 at the energy 650 MeV using the helical superconducting ondulator is presented. The energy spectrum of the Compton γ-quanta is given. The measured effect-to-background ratio is 1.5. Summarizing the results of the experiments carried out it is concluded that new technique of colliding beams polarization measurement using the helical ondulator provides in the conditions of the storage ring VEPP-2M a 10 per cent accuracy in the polarization degree measurement during a 45 s run and also enables determination of polarization direction. 3 refs.; 5 figs.

4990 (INIS-SU—62/A, pp 185-189) **Polarized antiprotons at LEAR.** Onel, Y.; Penzo, A.; Rossmanith, R. (Geneva Univ. (Switzerland); Trieste Univ. (Italy); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The perspectives of obtaining a complete description of the N-N amplitudes are limited, mainly because of the lack of polarized antiprotons. To overcome this deficiency the method of separating different spin states by the Stern-Gerlach effect in a storage ring is proposed and in particular the application of this idea at LEAR is discussed. The idea is to install in one of the straight sections in LEAR a combination of two quadrupoles with opposite sign and a solenoid in between. The solenoid rotates the spin by 180 degree so that the Stern-Gerlach kicks in both quadrupoles add up. 10 refs.; 3 figs.

4991 (INIS-SU—62/A, pp 190-191) **Spin resonances in high-energy electron storage rings: evaluation of the Derbenev-Kondratenko formula to arbitrary orders.** Mane, S.R. (Cornell Univ., Ithaca, NY (USA). Dept. of Physics). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A new algorithm to evaluate the equilibrium polarization in high-energy electron storage rings is given. The present approach includes all modes of orbital oscillation, to arbitrary orders. A computer program has been written to implement these ideas. 4 refs.

4992 (INIS-SU—62/A, pp 192-194) **Proposal to modify the storage ring VEPP-4M for experiments with longitudinally polarized beams.** Eidelman, Yu.I.; Muratov, V.V.; Zholents, A.A. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A proposal to modify the experimental straight section of VEPP-4M is presented. The aim to achieve a longitudinal spin polarization of electrons and positrons in the interaction point. A suitable adaptation of the longitudinal polarization scheme to the new

VEPP-4M optics has been found. The version of the insertion was chosen in such a way that no changes in the central part of the experimental straight section be needed. It gives a possibility to preserve the scheme of the strong focusing spectrometer and to continue the investigations of two photon interactions with already longitudinally polarized beams. 4 refs.; 2 figs.

4993 (INIS-SU—62/A, pp 195-200) **Nonlinear acceptance of a storage ring for polarization.** Kewisch, J.; Limberg, T.; Rossmanith, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

To predict the depolarization of electron beams at an energy of 34.5 GeV in a storage rings the spin tracking program SITROS is used. It takes into account the nonlinearities of the orbital motion and the spin precession up to the second order. It is shown that the neglected nonlinear terms can cause additional higher order resonances and a reduction of the degree of polarization by a reduction of the polarization acceptance of the storage ring. 10 refs.; 6 figs.

44 INSTRUMENTATION

4994 (SEGJ—8801, pp 363-364) **Calibrations of La-Coste-Romberg G308.** Kikuchi, Shin'ichi; Kitsunezaki, Choro; Okuzumi, Koichi; Nagasaki, Yasuhiko. (Iwate Prefectural Education Center, Iwate, Japan; Akita Univ., Mining College, Akita, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A LaCoste-Romberg G308 gravimeter has been in use for 10-odd years in Akita University (Japan). The gravimeter is currently operating satisfactorily without significant problems, though it has received maintenance by its manufacturer three times during the period because of troubles with its red-out mechanism. In fear of possible secular deterioration in the equipment, a study is made to review the records on calibration of the equipment that were made during the period. Each time maintenance was conducted, calibration of the gravimeter was carried out based on measurements made along calibration lines provided in the Tohoku district. No significant changes are identified in the measurements along the calibration lines, though reliability cannot be assured completely in view of the fact that the calibrations were conducted in winter and were not made along the same measurement lines. Calibration by using an inclined frame shows no noticeable abnormalities. There are no significant differences between conventional calibration values and theoretical values. (1 fig, 1 tab)

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 4759, 4809, 4835, 4934, 4984, 5215, 5405, 5506, 5535

4995 (ACIESP—60-Vol.4, pp 359-363) **Radiation dosimetry at IPEN.** Campos, L.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The dosimetric system used at IPEN, is presented. (E.G.).

4996 **(BONN-IR—88-13) Measurement of the magnetic field and field optimization of a 'type-H' dipole magnet.** Rahn, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1988. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755936/JAW.

The set-up of an 'type-H' dipole magnet is described. The magnet will be used together with a test drift chamber for studying problems of the central drift chamber of the OPAL detector. From the anticipated operation a gap of about 30-40 cm with a region of constant field of about 20x20 cm/sup 2/ required. The three components of field were measured, using a system of three hall sensors in 50x40x20 points with 1 cm spacing at an average field of 0.4 and 0.7 T, respectively. Using the method of finite elements optimal shimming was computed, resulting in a field constant within 1% over a region of approximately 20x15x10 cm/sup 3/. After applying these corrections the measured field maps are in excellent agreement with the calculated predictions. (HWJ).

4997 **(CEA-N—2566) Organization of a multichannel analyzer for gamma ray spectrometry.** Robinet, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Electronique et d'Instrumentation Nucleaire). Jun 1988. 120p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755993/JAW.

This report describes the software organization of a medium scale multichannel analyzer for qualitative and quantitative measurements of the gamma rays emitted by radioactive samples. The first part reminds basis of radioactivity, principle of gamma ray detection, and data processing used for interpretation of a nuclear spectrum. The second part describes first the general organization of the software and then gives some details on interactivity, multidetector capabilites, and integration of complex algorithms for peak search and nuclide identification ; problems encountered during the design phase are mentioned and solutions are given. Basic ideas are presented for further developments, such as expert system which should improve interpretation of the results. This present software has been integrated in a manufactured multichannel analyzer named 'POLYGAM NU416'.

4998 **(CERN-EP—88-80) Design of the forward RICH counter in DELPHI and results from the operation of a full-scale prototype.** Beltran, P.; Botner, O.; Dahl-Jensen, I.; Dam, P.; Damgaard, G.; Dris, M.; Dulinski, W.; Ekeloef, T.; Hallgren, A.; Herbst, I. (European Organization for Nuclear Research, Geneva (Switzerland)). 1 Jul 1988. 14p. (CONF-8709252—2). NTIS (US Sales Only), PC A03. Order Number DE89003196/JAW.

From International symposium on position detectors for high energy physics; Dubna, USSR (22 Sep 1987).

The purpose of the RICH counters in DELPHI is to provide $e/\pi/K/p$ identification, in particular at high energies (up to 20--30 GeV) where the particle identification based on dE/dx and time of flight has only a very limited reliability or none at all. In Fig. 1 is shown the result of a Monte Carlo simulation of the predicted identification capability of the Forward RICH counter in DELPHI. Particles of known identity (e, π, K, p) were generated in the core of a QCD jet and the full event was simulated in the Forward RICH counter. For each generated particle identify and as a function of the particle momentum, the figure shows the identification probabilities at the 4σ level for the reconstructed particle including possible ambiguities, e.g. e/π, π/K ambiguous identification. As part of the combined hadron-identification system of DELPHI, the physics motivations for an essentially 4π coverage are many. In the forward regions in particular, forward-backward asymmetry measurements of flavour-tagged jets are important goals. This paper contains a brief description of the overall design of the Forward RICH counter in DELPHI and a summary report on the results obtained with a full scale prototype of the counter operated in a 10 GeV/c pion beam from the CERN Proton Synchrotron (PS). 7 refs., 2 figs., 1 tab.

4999 **(CERN-EP—88-86) The fast strangeness trigger of the CPLEAR experiment.** Rickenbach, R.; Montanet, F.; Backenstoss, G.; Carlson, P.; Chardalas, M.; Franke, T.; Groenvik, K.; Kerek, A.; Kokkas, P.; Onofre, A.; Touramanis, C.; Transtroemer, G.; Wildi, M. (European Organization for Nuclear Research, Geneva (Switzerland); Basel Univ. (Switzerland); Manne Siegbahn Inst. (Sweden); Thessaloniki Univ. (Greece); Ioannina Univ. (Greece); LIP, Lisbon (Portugal)). 26 Jul 1988. 18p. (CONF-8806235—4). NTIS (US Sales Only), PC A03. Order Number DE89003194/JAW.

From International conference on advanced technology and particle physics; Como, Italy (12 Jun 1988).

To measure the CP violation in the neutral kaon system with initially pure K^0 and $\{bar K\}^0$ beams from the annihilation reaction $p\{bar p\} \rightarrow \pi^{+-} K^0(\{bar K\}^0)$ a good separation of pions and kaons is necessary. The properties of a particle-identification device making this separation possible and consisting of a scintillator Cherenkov scintillator sandwich are presented. 5 refs., 18 figs.

5000 **(CERN-EP—88-87) An electron-hadron separator for digital sampling calorimeters.** De Winter, K.; Geiregat, D.; Vilain, P.; Wilquet, G.; Bergsma, F.; Binder, U.; Burkard, H.; Capone, A.; Ereditato, A.; Flegel, W.; Grote, H.; Nieuwenhuis, C.; Overas, H.; Palladino, V.; Panman, J.; Piredda, G.; Winter, K.; Zacek, G.; Zacek, V.; Bauche, T.; Beyer, R.; Blobel, V.; Buesser, F.W.; Foos, C.; Gerland, L.; Niebergall, F.; Staehelin, P.; Tadsen, A.; Delbar, T.; Emsens, B.; Favart, D.; Gregoire, G.; Knoops, E.; Mouthuy, T.; Gorbunov, P.; Grigoriev, E.; Khovansky, V.; Maslennikov, A.; Rosanov, A.; Lippich, W.; Nathaniel, A.; Staude, A.; Caria, M.; Gorini, E.; Grancagnolo, F.; Iasevoli, R.; Strolin, P.; De Pedis, D.; Di Capua, E.; Dore, U.; Loverre, P.F.; Rambaldi-Frenkel, A.; Santacesaria, R.; Zanello, D. (European Organization for Nuclear Research, Geneva (Switzerland); Inter-University Inst. for High Energies, Brussels (Belgium); Hamburg Univ. (Germany, F.R.). 1. Inst. fuer Experimentalphysik; Louvain Univ. (Belgium); AN SSSR, Moscow. Inst. Teoreticheskoj i Eksperimental'noj Fiziki; Technische Univ. Muenchen, Garching (Germany, F.R.). Sektion Physik; Istituto Nazionale di Fisica Nucleare, Naples (Italy); Istituto Nazionale di Fisica Nucleare, Rome (Italy)). 26 Jul 1988. 13p. (CONF-8803159—2). NTIS (US Sales Only), PC A03. Order Number DE89003197/JAW.

From 3. topical seminar on perspectives for experimental apparatus at future high-energy machines and underground laboratories; San Miniato, Italy (7 Mar 1988).

A fast and effective algorithm for electromagnetic and hadronic shower separation has been developed for the digital sampling calorimeter of the CHARM II experiment. It is based on a generalization of the Minimal Spanning Tree concept and can be easily applied to other existing calorimeters. In this particular application, which requires the highest efficiency for retaining electromagnetic showers, one gets, for 99% efficiency a rejection factor of the order of 100 for hadronic showers. 9 refs., 8 figs.

5001 **(CERN-EP—88-91) Compact fast rich detector using a solid radiator: Principle and first experimental results.** Francke, T.; Montanet, F.; Pavlopoulos, P.; Rivoiron, C.; Santiard, J.C.; Suffert, M. (European Organization for Nuclear Research, Geneva (Switzerland); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 4 Aug 1988. 20p. (CONF-8806235—5). NTIS (US Sales Only), PC A03. Order Number DE89003188/JAW.

From International conference on advanced technology and particle physics; Como, Italy (12 Jun 1988).

The principle and first experimental results for a compact fast RICH detector using a solid radiator (NaF Crystal) are presented. This detector can be very thin ({congruent}4 cm) and presents a small percentage of radiation length. First experimental results for $\beta = 0.82$ and $\beta = 1$ particles at different incident angles indicate a good determination of the ring diameter. This type of particle identifier may be quite useful in compact medium energy experiments. 5 refs., 9 figs.

5002 **(CERN-EP—88-96) A ring-imaging detector with liquid and solid radiators using a multistep parallel-plate avalanche chamber at atmospheric pressure with optical readout.** Giomataris, Y.; Gougas, A.; Dominik, W.; Charpak, G.; Sauli, F.; Zaganidis, N. (European Organization for Nuclear Research, Geneva (Switzerland)). 8 Aug 1988. 18p. (CONF-8806235—3). NTIS (US Sales Only), PC A03. Order Number DE89003193/JAW.

From International conference on advanced technology and particle physics; Como, Italy (12 Jun 1988).

A parallel-plate multistep chamber, filled with He (97%) and C_2H_6 (3%) at atmospheric pressure, and tetrakis(dimethylamine)ethylene, with an optical readout system was tested. Laboratory tests using an ultraviolet flash lamp show a good single-photoelectron efficiency, spatial resolution better than 220 μm rms, and small spot-size (~3 mm FWHM) for the single-photoelectron avalanches. Tests in a 10 GeV particle beam confirm the good performance of the device, the high efficiency, the capability of very complex and dense position-information readout, and the suitability for imaging of high-energy gamma-rays. 13 refs., 13 figs.

5003 **(CONF-881011—30) Noise data management using commercially available data base software.** Damiano, B.; Thie, J.A. (Oak Ridge National Lab., TN (USA)). 25 Oct 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01. Order Number DE89002230/JAW.

From Joint meeting of the European Nuclear Society and the American Nuclear Society; Washington, DC, USA (30 Oct 1988).

A data base has been created using commercially available software to manage the data collected by an automated noise data acquisition system operated by Oak Ridge National Laboratory at the Fast Flux Test Facility (FFTF). The data base was created to store, organize, and retrieve selected features of the nuclear and process signal noise data because the large volume of data collected by the automated system makes manual data handling and interpretation based on visual examination of noise signatures impractical. Information is extracted from files created by the data acquisition system and written in a data base input file. A data loading program reads the input file and automatically stores the data in the data base. The data base contains information extracted from approximately 8000 spectra collected over nine fuel cycles. The FFTF noise data base contains significant features extracted from the noise spectra as well as information describing both the reactor state and signal conditioning during each measurement. The features extracted are the amplitude and frequency of peaks and the square of the root-mean-square calculated for 24 frequency intervals. The dc values of the reactor signals measured at the beginning and end of each measurement give the reactor state during each measurement. This work demonstrates how commercially available data base software can be applied to efficiently manage the large volume of data collected by an automated system. Automated data collection, information extraction, and data storage and manipulation eliminate the most tedious aspects of noise analysis and, compared to manual data handling, allow inferences and conclusions to be based on a much larger collection of data. The data base system for noise data management allows the automatically collected data to be effectively utilized, resulting in a more efficient and effective monitoring system. 5 refs., 6 figs., 5 tabs.

5004 **(CONF-881103—11) The physics of compensating calorimetry and the new CALOR89 code system.** Gabriel, T.A.; Brau, J.E.; Bishop, B.L. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89002976/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Much of the understanding of the physics of calorimetry has come from the use of excellent radiation transport codes. A new understanding of compensating calorimetry was introduced four years ago following detailed studies with a new CALOR system. Now, the CALOR system has again been revised to reflect a better comprehension of high energy nuclear collisions (HETC88) by incorporating a modified high energy fragmentation model from FLUKA87. This revision will allow for the accurate analysis of calorimeters at energies of 100's of GeV. Presented in this paper is a discussion of compensating calorimetry, the new CALOR system (CALOR89), the revisions to HETC, and recently generated calorimeter related data on modes of energy deposition and secondary neutron production ($E < 50$ MeV) in infinite iron and uranium blocks. 35 refs., 5 figs., 5 tabs.

5005 **(CONF-881103—12) Ruggedized alpha radiation detector.** McElhaney, S.A.; Chiles, M.M.; Lauf, R.J.; Bauer, M.L. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 7p. NTIS, PC A02. Order Number DE89003106/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

The objective of this project is to develop an alpha radiation scintillation detector with an entrance window more rugged than conventional types. A new technique for micromachining thin silicon windows has been implemented. Optically clear epoxy is used to couple the scintillator material to a glass light pipe and to give support to the thin portions of the silicon window. Tests indicate overall efficiency is comparable with conventional Mylar window detectors. 3 refs.

5006 **(CONF-881151—26) Digital characterization of recoil charged-particle tracks for neutron measurements.** Turner, J.E.; Hunter, S.R.; Hamm, R.N.; Wright, H.A.; Hurst, G.S.; Gibson, W.A. (Oak Ridge National Lab., TN (USA); Pellissippi International, Knoxville, TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89002210/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

We are developing a new optical ionization detector for imaging the track of a charged neutron-recoil particle in a gas. Electrons produced in the path of the recoil particle are excited by an external, high-voltage, RF, electric field of short duration. Their oscillatory motion causes ionization and excitation of nearby gas molecules, which then emit light in subsequent de-excitation. Two digital cameras image the optical radiation across two perpendicular planes and analyze it for the numbers of electrons in various volume elements along the track. These numbers constitute the digital characterization of the track. This information can then be used to infer the energy deposited in the track and the track LET in the gas. We have now observed alpha-particle tracks in a chamber utilizing these principles. The application of such a device for neutron dosimetry and neutron spectrometry will be described. 4 refs., 3 figs.

5007 **(CONF-881232—5) Dual scintillator with pulse shaping electronics as a wide-energy range neutron detector.** Chiles, M.M.; McElhaney, S.A.; Todd, R.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01. Order Number DE88016720/JAW.

From 22. health physics midyear topical meeting on instrumentation; San Antonio, TX, USA (4 Dec 1988).

Because of continued concern and need for improved neutron monitoring and surveillance around nuclear facilities and weapons, where the possibility of fission excursions exists, we are investigating several neutron-sensitive scintillators and combinations for development into a smaller, more compact, wide-energy neutron detector. The scintillation detector reported here is comprised of two scintillators optically coupled and mounted on a single photomultiplier tube. The first scintillator is a ^{6}Li-loaded glass, which has a high efficiency for thermal neutrons, and the second is a plastic scintillator (BC 400), which has fairly high efficiency for higher energy neutrons. The ^{6}Li glass scintillator emits light with a time constant of {approximately}60 ns, whereas the time constant of light emission from the plastic scintillator is {approximately}3 ns. This difference in characteristic time constants between the two scintillators is conducive to electronic separation of the pulses occurring in each scintillator. Pulse shaping and timing electronics have been combined to accomplish this, allowing the thermal neutron activity as well as the activity of the higher energy neutrons present to be counted. 1 ref., 5 figs.

5008 **(DOE/ER/01545—416) A fine grain modular detector for low energy particles.** Durkin, L.S.; Fitch, J.S.; Harper, R.W.; Heimaster, J.W.; Larsen, D.R.; Ling, T.Y.; Mitchell, J.W.; Romanowski, T.A.; Rush, C.J.; Sehgal, V.K. (Ohio State Univ., Columbus (USA); Louisiana State Univ., Baton Rouge (USA)). [1988]. Contract AC02-76ER01545;AS05-77ER05490. 36p. NTIS, PC A03/MF A01. Order Number DE89003385/JAW.

Design and performance of a fine grain detector with mass of 20 tons composed of liquid scintillator and proportional drift chamber planes is described. 9 refs., 20 figs.

5009 **(DOE/ER/40257—4) Non-accelerator particle physics: Progress report for period February 1, 1988--January 31, 1989.** (Drexel Univ., Philadelphia, PA (USA). Dept. of Physics and Atmospheric Science). Nov 1988. Contract AC02-86ER40257. 33p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003678/JAW.

The goals of this research are the experimental testing of fundamental theories of physics such as grand unification and the exploration of cosmic phenomena through the techniques of particle physics. We are currently engaged in construction of the MACRO detector, an Italian-American collaborative research instrument with a total particle acceptance of 10,000 m^2sr, which will perform a sensitive search for magnetic monopoles using excitation-ionization methods. Other major objectives of the MACRO experiment are to search for astrophysical high energy neutrinos expected to be emitted by such objects as Vela X-1, LMC X-4, and SN-1987A and to search for low energy neutrino bursts from gravitational stellar collapse. We are also working on GRANDE, a proposed very large area surface detector for astrophysical neutrinos, and on the development of new techniques for liquid scintillation detection. 18 refs.

5010 **(DOE/ER/40339—2) [Fast neutron cross section measurements]: Progress report.** (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). [1988]. Contract FG02-87ER40339. 41p. NTIS, PC A03. Order Number DE89003028/JAW.

As projected in our previous proposal, the past year on the cross section project at the University of Michigan has been one primarily of construction and assembly of our 14 MeV pulsed Neutron Facility. All the components of the system have now been either purchased or fabricated in our shop facilities and have been assembled in their final configuration. We are now in the process of testing the rf components that have been designed to deliver voltage to both the pulser and buncher stages. We expect that the system will be operational by the end of the current contract year. We have also accomplished the design and construction of several other major pieces of equipment that are needed to begin fast neutron time-of-flight measurements. These include the primary proton recoil detector, and a californium fission chamber needed in the efficiency calibration of the primary detector. We have also added considerable concrete shielding designed to lower the neutron background in the experimental area. 10 figs., 5 tabs.

5011 **(GSI—87-6) Feasibility study of a 4π-detector for SIS/ESR.** Albrecht, R.; Bock, R.; Freifelder, R.; Gobbi, A.; Grigorian, Y.; Herrmann, N.; Hildenbrand, K.D.; Reisdorf, W.; Schuell, D.; Simon, R.S.; Darmstadt-Giessen-Heidelberg-Muenster Collaboration. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.; Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.; Muenster Univ. (Germany, F.R.). Physikalisches Inst.). Mar 1987. 102p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755568/JAW.

Basic physical questions concerning transient states of dense nuclear matter which are produced in central nucleus-nucleus collisions are discussed. The necessity to build a 4π facility at SIS/ESR is documented. The feasibility of total coverage of the full solid angle for photons and charged particles is studied in detail and a conceptual design is presented. The necessity to reduce the complexity of the instrument for practical reasons is discussed and a gradual implementation of the facility is proposed.

5012 (INIS-mf—11324, pp 8-9) **Nuclear spectroscopy of low-energy electrons: its scope and some new topics.** Dragoun, O. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5013 (INIS-mf—11324, pp 14-15) **XRF-analysis. Status and future.** Jongh, W.K. de. (Philips Export bv, Eindhoven (Netherlands)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5014 (INIS-mf—11324, pp 152) **New and improved methods and instrumentation for surface analysis with electron spectroscopy.** Ringel, G. (Leybold A.G., Koeln (Germany, F.R.)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5015 (INIS-mf—11324, pp 157) **Some fast atom bombardment applications on novel magnetic sector mass spectrometer.** Clench, M.R.; Owen, R.; Waddicor, J.I. (VG Tritech, Manchster (UK)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5016 (INIS-mf—11324, pp 134) **Auger N(E) spectrum measurement using BBM method.** Tomek, S.; Liday, J.; Benkowsky, I. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Strojnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5017 (INIS-mf—11324, pp 135) **Information depth of different kinds of the appearance potential spectroscopy.** Eckertova, L.; Steiner, A. (Karlova Univ., Prague (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5018 (INIS-mf—11328, pp 54) **Improved algorithm for evaluation of three-dimensional neutron depolarisation measurements.** Badurek, G.; Weinfurter, H.; Leeb, H.; Veider, A. (Technische Univ., Vienna (Austria); IBM Research Lab., Zurich (Switzerland)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5019 (INIS-mf—11328, pp 58) **FADC with a time measurement option.** Pernicka, M.; Schmiedmayer, J. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik; Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5020 (INIS-mf—11328, pp 56) **Measurement of the streamer pulse in a tube with quadratic cross-section.** Erd, C.; Leder, G.; Pernicka, M.; Regler, M.; Schnizer, B. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik; Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5021 (INIS-mf—11328, pp 79) **Implementation of a Kalman filter at the heavy ions experiment NA36.** Liko, D. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5022 (INIS-mf—11328, pp 80) **Vertex determination in the Delphi experiment (Strategies and results from Monte Carlo data).** Mitaroff, W.A. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5023 (INIS-SU—58, pp 33-36) **Applied software for microprocessor multielement X-ray radiometric analyzers.** Golovin, A.A.; Prokhorenko, A.N.; Varvaritsa, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

A packet of applied programs FA-3 for application in 8-bit microsystems used for multi-element x-ray radiometric analyzer designs is described. Principles of program packet incorporation into particular equipment are shown. The considered version of FA-3 program packet is designed for realization of analyzers based on proportional counters. Algorithms of an automatic search for peaks and automatic analyser stabilization are presented. Taking a portable multi-element RAP-1M analyzer as an example it is shown that application of a ready FA-3 program packet allows one to reduce time required for its software approximately 50-fold if one uses concentration calculation methods incorporated into it and 25-fold-under their independent programming. Further it is assumed to develop new versions of applied FA-3 program packet. In particular, FA-4 paket for operation with a semiconductor detector will be developed in the nearest future. A possibility of incorporating graphics for laboratory analyzers into the program packets is considered. 7 refs.; 2 figs.

5024 (INIS-SU—58, pp 65-67) **On-line system for monitoring the neutron yield in the NG-150 type generator.** Alekseev, I.N.; Bortash, A.I.; Kudryashov, A.S. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

The on-line system for monitoring the neutron yield in NG-150 generator, designed as a result of neutron counter channel connecting up with a microcomputer and permitting to receive information about activity change in the specimens irradiated or about the neutron fluence growth, taking into account the fluctuations of the generator yield, is described. The hard- and software system is considered. 2 refs.; 3 figs.

5025 (INIS-SU—58, pp 9-12) **Using the detectors of new types in radiometric defectoscopy.** Kolyubin, V.A.; Mavryashin, S.N. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Consideration is being given to results of experimental investigations of characteristics of two types of combined detectors: CsI(Tl) scintillator - CdS photoresistor and CsI(Tl) scintillator - silicon photodiode - as well as of some detectors, based on CdTl, HgI/sub 2/ wide-band semiconductors and silicon sandwich structures. Investigations conducted in the field of /sup 60/Co γ-radiation (E/sub ν/ = 1.25 MeV) showed that detectors on the base of cadmium telluride and scintillator-photodiode combination were the most perspective radiometric detectors. They can be improved sufficiently, despite the fact, that these detectors can't be used for con-

trol of products with thickness of above 270 mm with respect to aluminium due to their low sensitivity. 3 refs.; 3 figs.

5026 (INIS-SU—58, pp 36-42) **Optimization of parameters of single-beam gamma absorption concentration meter within definite measuring range.** Yakovlev, E.I.; Terent'ev, V.P. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Problems of two-parametric optimization of single-beam gamma absorption concentration meters in the assigned measurement range are considered. It is shown that maximum absolute and relative statistical measurement errors are observed at the measurement range boundaries under any values of variable parameters. Optimization of single-beam gamma absorption concentration meter parameters for a number of binary solutions is performed. 4 refs.; 6 figs.; 3 tabs.

5027 (INIS-SU—58, pp 42-46) **Peculiarities in optimization of the parameters of single-beam concentration meter in case of counting rate limitation at measuring range boundary.** Yakovlev, E.I.; Terent'ev, V.P.; Zharkov, V.A.; Khakhalin, V.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Transition from optimization of single-beam absorption concentration meter parameters in the assigned measurement range at minor loads to optimization under a rigid limitation on the measuring path capacity is considered. It is shown that in this case two-parametrical calibration function is degenerated into a dependence on the only generalized parameter. Simple analytical expressions for calculating the optimal values of the generalized variable parameter and optimized error are derived in cases of decreasing and increasing counting rate dependences on the determined component concentration. Peculiarities of optimizing concentration meter parameters under limitations applied to translucent layer thickness choice and counting rate in the absence of the medium under investigation are considered. 3 refs.; 3 figs.

5028 (INIS-SU—58, pp 46-48) **Compensation of statistical error of radioisotope device in measuring range.** Terent'ev, V.P.; Yakovlev, E.I.; Khakhalin, V.V.; Puchkova, L.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).
In Radiation technology. Scientific-technical collection.

Data on optimal calibration dependences providing for stability of statistical error (absolute and relative) in the measurement range are generalised. Recommendations allowing one to perform measurements so that to obtain a stable statistical error for arbitrary calibration dependence are presented. 2 refs.

5029 **(LA-UR—88-3733) A tracking rangefinder for muons from kaon decay.** Frank, J.; Hart, G.W.; Kinnison, W.W.; Lee, D.M.; McKee, R.J.; Milner, E.C.; Sanders G.H.; Ziock, H.J.; Chapman, M.; Eckhouse, M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881103—15). NTIS, PC A02/MF A01. Order Number DE89003480/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

A muon rangefinder with tracking capabilities has been constructed as part of a search for the rare decay K{degree}/sub L/ $\rightarrow \mu e$ in experiment 791 at the Brookhaven National Laboratory Alternating Gradient Synchrotron. The rangefinder consisted of two identical arms, symmetric about the beamline, and was the final detector element in a spectrometer system. Each side of the rangefinder was comprised of 75 slabs of marble and 25 slabs of aluminum, each 7.62 cm thick, covering an acceptance area 225 cm wide by 301 cm high, with a total mass of 160 tons (145,454 kg). There were 13 pairs of x- and y-measuring proportional tube planes providing a nominal +-10% accuracy measurement of muon momentum. Altogether, there were 11,648 sense wires, operating at 2650 V, with equal parts argon (49.2%) and ethane (49.2%) gas, and a small amount (1.6% of the total gas) of ethyl alcohol flowing in the proportional tubes. During 850 hours of data collection, efficiency averaged 94% with 160-ns drift time at 1.5 μA threshold. For well-identified muon tracks, rangefinder muon identification was 99% efficient when penetration to at least 60% of the depth expected from spectrometer-derived momentum was required. 6 refs., 6 figs.

5030 **(PTB-EW—5) Scintillation dosemeter. Measuring characteristics of the probe.** Seyfried, P.; Ebeling, G. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Elektronische Entwicklung). Feb 1988. 61p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755978/JAW.

The study examines organic scintillators (Ne 102 A with a thin film of ZnS (Ag) and secondary electron multipliers of the type EMI 9635 B) for their performance under different temperatures, during and after strong overloading, saturation phenomena due to large, momentary pulses, and for the effects of magnetic fields. Applicability of other scintillators is also studied. Quantitative data on the various impacts are presented and are described by formulae whenever possible. Particularly disturbing effects are characterized by reliable upper limits. Calibration methods for scintillator probes are explained that require only few measuring work. All studies used probes with EMI 9635 B multipliers as this type has been found to have the best signal-to-noise ratio. (orig./HSCH).

5031 **(SLAC-PUB—4723) The Liquid Argon Calorimeter system for the SLC Large Detector.** Haller, G.M.; Fox, J.D.; Smith, S.R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 5p. (CONF-881103—17). NTIS, PC A02 - OSTI. Order Number DE89003785/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

In this paper the physical packaging and the logical organization of the Liquid Argon Calorimeter (LAC) electronics system for the Stanford Linear Collider Large Detector (SLD) at SLAC are described. This system processes signals from approximately 44,000 calorimeter towers and is unusual in that most electronic functions are packaged within the detector itself as opposed to an external electronics support rack. The signal path from the towers in the liquid argon through the vacuum to the outside of the detector is explained. The organization of the control logic, analog electronics, power regulation, analog-to-digital conversion circuits, and fiber optic drivers mounted directly on the detector are described. Redundancy considerations for the electronics and cooling issues are discussed. 12 refs., 5 figs.

5032 **(SLAC-PUB—4738) A cryogenic monitor system for the Liquid Argon Calorimeter in the SLD detector.** Fox, M.J.; Fox, J.D. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 5p. (CONF-881103—4). NTIS, PC A02/MF A01. Order Number DE89002840/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

This paper describes the monitoring electronics system design for the Liquid Argon Calorimeter (LAC) portion of the SLD detector. This system measures temperatures and liquid levels inside the LAC cryostat and transfers the results over a fiber-optic serial link to an external monitoring computer. System requirements, unique design constraints, and detailed analog, digital and software designs are presented. Fault tolerance and the requirement for a single design to work in several different operating environments are discussed. 4 refs., 3 figs., 1 tab.

5033 **(SLAC-PUB—4751) Performance of the electronics for the Liquid Argon Calorimeter system of the SLC large detector.** Vella, E.; Abt, I.; Haller, G.M.; Honma, A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-881103—5). NTIS, PC A02/MF A01. Order Number DE89002838/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

Results of performance tests on electronics for the Liquid Argon Calorimeter (LAC) for the SLD experiment at SLAC are

presented. The behavior of a sub-unit called a "tophat," which processes 720 detector signals, is described. The electronics consists of charge sensitive preamplifiers, analog memories, A/D converters, and associated control and readout circuitry. An internal charge injection system is used to calibrate the overall response of the devices. Linearity is better than 1% of 0--28 pC charge at the input of the amplifiers. Noise (expressed as equivalent input charge) is less than 3000 electrons at a shaping time of 4 μs, with a slope of 2600 e/sup {minus}//nF. Crosstalk to adjacent channels is less than 0.5%. The power consumption at a duty cycle of 13% is 61 W. 3 refs., 7 figs.

5034 **(SLAC-PUB—4757) A FASTBUS flash ADC system for the Mark II vertex chamber.** Barker, L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-881103—6). NTIS, PC A02/MF A01. Order Number DE89002837/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

This is a description of a flash ADC system built for the Mark II experiment at the Stanford Linear Accelerator Center (SLAC). This system was designed for use in the experiment's vertex chamber where signals could occur over a relatively long time, approximately 10 microseconds. This long time, coupled with fast cable amplifiers, necessitated an alternate design approach than was used with a dE/dX FASTBUS flash ADC design. 1 ref., 6 figs.

5035 **(UCID—21547) Using the transportable, computer-operated, multisphere neutron spectrometer system.** Thorngate J.H. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1988. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003712/JAW.

Multisphere neutron spectrometers have found wide use for radiation dosimetry because they measure over a broad energy range with reasonable sensitivity. Although taking data with a multisphere system is relatively easy, deducing the neutron spectrum from the limited data obtained requires a computer. The advent of lap-top personal computers has made it possible to take an adequate computer into the field. We have combined such a portable computer with a compact set of electronics. Our system is reasonably transportable, in which the computer program guides the operator through the entire process of setting up the apparatus, taking the data, and deducing the neutron spectrum from the results. 6 refs., 45 figs.

5036 **Voltage-assisted calorimetric ionization detector.** Luke, P.N. (Office of Electronics Engineering, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Applied Physics;* **64**: No. 12, 6858-6860(15 Dec 1988).

A new approach to ionizing radiation detection is proposed. The amount of ionization produced in a detector medium is measured by the heat generated as the charged carriers are drifted across the device under an applied voltage. The amount of energy generated can be orders of magnitude larger than that deposited by the radiation itself. A dramatic increase in detector mass can be achieved compared to simple calorimetric particle detectors for equivalent energy thresholds. It is possible to obtain a sensitivity level sufficient for single-carrier detection. The principle of operation has been demonstrated with an experimental device operated at a temperature of 1.8 K, and improved performance is expected at lower temperatures.

5037 **Extended range radiation dose-rate monitor.** Valentine, K.H. (to Dept. of Energy, Washington, DC). US Patent 4,767,929. 30 Aug 1988. Filed date 6 Oct 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

An extended range counter system is described for measuring ionizing radiation dose-rates up to at least 1000 R/h, comprising: an ionizing radiation detector means for producing current pulses at a rate corresponding to the photon interaction rate of ionizing radiation to be detected and having an amplitude proportional to the charge deposited by each photon of radiation detected; an amplifier means responsive to each of the current pulses for generating fixed width voltage pulses at an output thereof having an amplitude proportional to the amplitude of the current pulses; a comparator means having a signal input connected to the output of the amplifier means and a reference voltage input for generating a logic pulses at an output thereof for each input pulse from the amplifier means which exceeds the comparator means threshold determined by a reference voltage level applied to the reference voltage input of the comparator means; an integrator means connected to the output of the comparator means for integrating the logic pulses to provide an output signal proportional to the rate of logic pulses applied to the input thereof; a signal feedback means for feeding back a selected portion of the output signal from the integrator means to the reference voltage input of the comparator means to vary the comparator means threshold so that as the radiation dose-rate detected by the detector means increases the comparator means threshold increases to extend the sensitive dynamic range of the system up to at least 1000 R/h; and a meter connected to the output of the integrator means and calibrated to indicate measured radiation dose-rate in response to the output signal of the integrator means.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

5038 **(INIS-mf—11851) NEMP effects on domestic installation. Measurements carried out in a building of the Landesnervenklinik Alzey.** Braun, C.; Clemens, P.; Graf, W.; Guidi, P.; Schmidt, H.U. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Euskirchen (Germany, F.R.). Inst. fuer Naturwissenschaftlich-Technische Trendanalysen). May 1985. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755958/JAW.

Fraunhofer-Institut fuer Naturwissenschaftlich-Technische Trendanalysen (INT). Bericht.; no. 126.

The measurements have been made in a building of a psychiatric clinic at Alzey/West Germany. The building has been chosen for the measuring campaign because it has its own electrical installation for mains current supply and emergency power supply, apart from systems of the other buildings. The two supply systems DONNERSBERG could be cut off completely from the other mains systems, so that coupling and feed experiments could be made without mains voltage. Current supply to the measuring systems was done by means of extension cables, or by batteries. The wiring for connection to the room circuits is parallel to the exterior wall, so that measurements could be done by using a frame antenna placed outside of the building parallel to the exterior wall.

5039 (INIS-SU—58, pp 48-51) **Reconstructibility of the sensitivity of gamma detection counting scintillation units with organic detectors after irradiation by high-power short gamma quanta flux.** Garnyk, D.V.; Zubchenko, B.A.; Lutfulaev, A.A.; Skoblo, Y.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Reconstructibility of the sensitivity of counting scintillation detection units with organic detectors after irradiation by high-power (up to 10/sup 4/ R) short gamma quantum flux is investigated. It is shown that under appropriate PEM supply voltage choice the time of reconstruction of sensitivity of counting detection units with stilbene- and polystyrene base detectors does not exceed 10 min. 4 refs.; 4 figs.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 4108, 4180, 4232, 4270, 4747, 4749, 4757, 4841, 4914, 4927, 5113, 5681, 5711

5040 **(BNL—41807) The heritage of radiotracers for PET.** Fowler, J.S.; Wolf, A.P. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 13p. (CONF-8805211—2). NTIS, PC A03/MF A01. Order Number DE89001608/JAW.

From 12. Sigrid Juselius Foundation symposium on tracers in diagnostic imaging; Helsinki, Finland (22 May 1988).

The history of PET research clearly demonstrates that it is advances in chemistry coupled with a detailed examination of the biochemistry of new radiotracers which has allowed the PET method to be applied to new areas of biology and medicine. Radiotracers whose regional distribution reflects glucose metabolism, neutrotransmitter activity and enzyme activity have all required the development of rapid synthetic methods for the radiotracers themselves and the characterization of their biochemical behavior. This article traces some of the advances in the production of labeled precursors and in radiotracer synthesis and evaluation which have shaped the rapidly expanding application of PET to problems in the neurosciences, in cardiology and in oncology. 54 refs.

5041 **(BNL—41812) An improved double fluorescence detector for fluorescence EXAFS [Extended X-ray Absorption Fine Structure] measurements.** Heald, S.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 9p. (CONF-8808141—3). NTIS, PC A02/MF A01. Order Number DE89002173/JAW.

From 3. international conference on synchrotron radiation instrumentation; Tokyo, Japan (29 Aug 1988).

In many cases the fluorescence EXAFS signal is contaminated with fluorescence from nearby elements. If this fluorescence is of lower energy than the element of interest, x-ray filters are not effective. One method for dealing with this problem is the double fluorescence method described by Wong and Rao. This paper describes an improved version of this double fluorescence scheme which greatly improves its efficiency. Data are presented for a sample of 1/2% Hf in Ni_3Al, and 1.6% CuO in NiO. When standard fluorescence is used, both signals are almost completely obscured by the ≅100X larger Ni K fluorescence signal. With the double fluorescence detector the Hf L_3 and Cu K-edge signals are clearly observed and good spectra can be obtained in about an hour. 4 refs., 4 figs.

5042 **(CERN-EP—88-94) Wide angle, high energy gamma ray Cherenkov telescope with good energy resolution.** Giomataris, I.; Charpak, G. (European Organization for Nuclear Research, Geneva (Switzerland)). 5 Aug 1988. 10p. (CONF-870855—6). NTIS (US Sales Only), PC A02. Order Number DE89003192/JAW.

From 20. international cosmic ray conference; Moscow, USSR (2 Aug 1987).

The detection of high energy γ-rays, in the range of a few tens of MeV to few tens of GeV, is of interest in various fields, particle physics and astrophysics being our main objects. It is often difficult to attain at the same time a high efficiency, a good energy resolution and a good angular resolution. We describe in this article the principle of a detector which combines these three qualities and which relies on recent techniques developed for high-energy particle physics. 10 refs., 4 figs.

5043 **(DOE/ER/13683—2) An automated flow calorimeter for heat capacity and enthalpy measurements at elevated temperatures and pressures: Progress report for period March 1, 1988--February 29, 1989.** Yesavage, V.F. (Colorado School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). 30 Oct 1988. Contract FG02-87ER13683. 23p. NTIS, PC A03/MF A01. Order Number DE89003432/JAW.

The need for thermal property data at process conditions has been well documented in applications such as development of atmospherically inert refrigerants and design of petrochemical and synfuel plants. As such, the primary objective of this work is to construct an automated flow calorimeter to measure isobaric heat capacities and enthalpies of vaporization over the range 0--30MPa and 300--700K with an anticipated accuracy of 0.1%. The method of measurement is an adiabatic electrical power input technique with a unique calorimeter design utilizing a concentric coil/radiation shield structure which minimizes heat loss errors and simplifies the replacement of plugged components. Flow generation is accomplished with a precision Ruska pump eliminating the need for on-line flow rate measurement. In addition, the proposed instrument will be fully automated minimizing the need for highly skilled operators which had previously been a severe limitation with this type of instrument. Assembly of all hardware and implementation of the necessary software was completed within the past year. In addition, water was used as a heat capacity standard to evaluate overall system performance. Preliminary indications are that the apparatus is operating near expectations (+/{minus}0.2%) although some additional hardware refinements may be necessary achieve the design goals of +/{minus}0.1%. 15 refs., 4 figs., 1 tab.

5044 (INIS-SU—58, pp 60-63) **Ion source with surface ionization using the rod-type device for sample input.** Kashcheev, V.V.; Sysoev, A.A.; Kir'yanov, G.I.; Akopov, K.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Description of the modernized three-band ion source for the MI 1201 mass spectrometer is presented. One of the spectrometer evaporator is placed on the rod-type device for sample input, which permits to remove the evaporation into the atmosphere without vacuum disturbance for sample application. Advantages of application of the modernized ion source providing higher accuracy, reproducibility, expressness of mass-spectrometry analysis in comparison with the series one is shown. The relative random error when measuring by the two-way method in case of application of the modernized source does not exceed 0.2%, and in case of the series source - 0.5%. 3 refs.; 1 fig.

5045 (INIS-SU—59/A, pp 78) **Methods of data processing in neutron diffraction studies of amorphous metals using a pulsed source.** Isakov, S.L.; Ishmaev, S.N. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780006/JAW.

Voprosy atomnoj nauki i tekhniki.; no.4(40).

In General and nuclear physics. Scientific-technical collection.

5046 **(NP—9770004) Calorimeters. Fundamentals and practical application.** (Bayerisches Staatsministerium fuer Wirtschaft und Verkehr, Muenchen (Germany, F.R.)). [1986]. 36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770004/JAW.

Descriptions of calorimeters, remarks on their uses, practical application and manufacturers to refer to are followed by data and facts on heat meters. A separate chapter is dedicated to calorimeters of the electrical measured value type (designs, displays, measuring of mean radiator temperatures, integration of room temperatures, varying tolerances, battery and aging problems). Concerning the measuring methods applied, electronic systems are considered to be clearly superior to evaporimeters. The main advantages of electronic systems consist in their high resolution and correspondingly low-priced smallest display units as well as in their easy and precise reading. Disadvantages lie in their prices, interference susceptibility, service life, aging, and varying qualities and tolerances. (HWJ).

5047 (SEGJ—8801, pp 340-345) **Improvement of S/N ratio by the method of digital data stacking on magnetic survey of buried iron materials.** Naito, Yoshihiro; Takaku, Kazuhiko; Agu, Toshio. (Daiwa Exploration and Consulting Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A method for magnetic surveys of iron materials is developed which prevents vibrational noise from being caused during

the transfer of the sensor by miscellaneous iron materials in and around the survey sate. Experiments with the method are conducted. A double-coil magnetic gradient measuring device is used to obtain several sets of five measurements made under the same conditions. Each set of measurements are made with varying distances between the sensor and magnet. Data once stored on a microfloppy disk are transferred to a microcomputer for processing for noise reduction and profile refinement. Then, stacking is carried out and results are displayed on an X-Y plotter. Original and processed data are compared to demonstrate that the stacking method can greatly improve the S/N ratio. Application of the stacking method to each set of recorded measurements serves to clearly identify maxima and zero points, making it easy to determine the period and amplitude accurately. This reduces errors in calculations of magnetic quantities. It is also revealed that the stacking can greatly reduce vibrational noises including those caused by personnel walking in the site. (7 figs)

5048 **(UCID—21458-Rev.1) Fundamental limitations and trade-offs for high power microwave generation with photoconductors.** Pocha, M.D. (Lawrence Livermore National Lab., CA (USA)). 4 Oct 1988. Contract W-7405-ENG-48. 16p. NTIS, PC A03/MF A01. Order Number DE89002852/JAW.

There has recently been much interest in photoconductive devices as high speed, low jitter, high power switches for use in high power microwave generation systems. While photoconductive switches are very promising devices there are some fundamental limits and trade-offs which must be considered in attempting to apply them to high power microwave generation. The purpose of this report is to describe the more important of these fundamental limits and trade-offs and to present some criteria for comparison of various circuit and system approaches. 1 ref., 1 fig.

5049 **(UCRL—99860) Distributions for seismic signal representation.** Harris, D.; Hauk, T.; Goldner, M.; Kurtzer, M. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 6p. (CONF-8810202—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89002900/JAW.

From 22. Asilomar conference on signals, systems and computers; Pacific Grove, CA, USA (30 Oct 1988).

This paper describes an application of distributions (e.g. spectrograms) to the interpretation of continuous data streams from seismic array stations. Such data representations can be used to construct an analyst interface for the purpose of screening large quantities of data. Three types of distributions are considered: spectrograms (energy vs. frequency and time), bearing and slowness distributions (energy vs. direction or slowness and time). The main seismic interpretation functions of detection, wave identification and association, location, and event classification can be performed from a visual inspection of an appropriate combination of distributions and trace displays. A system based on data "visualization" should have high throughput and perform well in a nuclear test ban treaty verification role. 1 ref.; 5 figs.

5050 **Broadband microwave absorption spectrometer for liquid media.** Mukherjee, P.; Gosnell, T.R.; Bigio, I.J. (MS-E543, CLS-5, Chemical and Laser Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **59**: No. 12, 2577-2582(Dec 1988).

A broadband, continuous-sweep microwave spectrometer has been constructed for measurements of the absorption coefficient of aqueous solutions and other liquid media. The spectrometer makes use of the phase fluctuation optical heterodyne technique, which provides a direct measure of the microwave power deposited in the sample. Consequently, in contrast to the standard dielectrometric techniques that indirectly determine the absorption coefficient via separate measurements of the real and imaginary parts of the dielectric constant, this spectrometer directly measures the microwave absorption coefficient. Broadband spectra are obtained using a transmission line to couple microwave power into the liquid sample. The absorption spectrum for deionized water in the range 3—20 GHz is presented as an example and shows excellent agreement with calculated values of the absorption coefficient based on previously published dielectric data.

5051 **Interferometric apparatus and method for detection and characterization of particles using light scattered therefrom.** Johnston, R.G. (to Dept. of Energy, Washington, DC). US Patent 4,764,013. 16 Aug 1988. Filed date 23 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes an apparatus for the identification and characterization of particles in a sample by observing light scattered therefrom, comprising in combination: means for producing a first radiation having a first wavelength and a first polarization; means for producing a second radiation substantially collinear with the first radiation and having a second wavelength and a second polarization substantially orthogonal to the first polarization; containment means containing the sample, for allowing the first and second radiations to scatter from collisions with the particles in the sample; polarization means receiving scattered first and second radiations for resolving the scattered first and second radiations, the polarization means having an axis of transmission along which resolved scattered first and second radiations pass; photodetector means receiving and detecting the resolved scattered first and second radiations for outputting a beat frequency resulting from interaction between the resolved scattered first and second radiations, the beat frequency having a relative phase and amplitude; and measurement means receiving the beat frequency for measuring and outputting the relative phase of the beat frequency, for use in identifying and characterizing the particles.

5052 **Interferometric metrology; Proceedings of the Conference, San Diego, CA, Aug. 20, 21, 1987.** Massie, N.A. Bellingham, WA; Society of Photo-Optical Instrumentation Engineers (1988). 245p. (CONF-8708292—).

From Interferometric metrology conference; San Diego, CA, USA (20 Aug 1987).

Recent advances in interferometric measurement technology are discussed in a collection of review essays and summaries of industrial experience. Topics examined include interferometric testing of aspheric surfaces, digital heterodyne interferometry, automated fringe-reduction techniques, and surface measurements with a noncontact Nomarski profiling instrument. Consideration is given to holography of phase objects, absolute distance interferometry, and wavefront measurement by shearing interferometry.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 4143, 4208

5053 (SEGJ—8801, pp 73-76) **Development of locking device for new velocity logging system.** Kokura, Kimio; Ohashi, Takeichiro; Inuma, Hiroyuki. (Oyo Corp., Saitama, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A probe which can fix monitors in the interior of a borehole was developed. By this system, a detachable container which accommodates required monitors and seismic sources, is mounted in the probe interior. The probe has two rigid arms. In application, the arms are opened so as to press the tops of the arms and the back plate of the probe against the borehole wall, or are closed for detachment. The two arms are opened or closed by means of a motor and a spline shaft. The minimum bore diameter for application is 56 mm, and the diameter of the probe is 52 mm. The features of the probe are as follows: The probe can be used, irrespective of the presence of water in a borehole. Moreover, the probe is prevented from suffering noises when water exists in the borehole; the compact and light-weight probe can be sufficiently used on soft ground; a connected multi-probe system is possible; the container to accommodate monitors and seismic sources in the probe is exchangeable; and the probe has such a structure as to be prevented from jamming. (3 figs)

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 4847, 4848, 4886

5054 **(IES—8801) Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.** (Industrial Explosives Society, Tokyo (Japan)). 11 May 1988. 139p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

Following lectures were made on May 12 and 13 of 1988. Propellant: Basic study, etc. 10 reports on propellant. Disaster prevention and pollution: Wall vibration by the explosion having a structure, etc., 13 reports. Explosion pressure: Deformation of metal plate by detonation wave tube, etc., 3 reports. Blasting: Collectively controlled blasting system by MBS, etc., 4 reports. Explosion, combustion and decomposition: Spectroscopy of cylinder conversion detonation, etc, 11 reports. Sensitivity: Statistical analysis of static sensitivity test results, etc., 6 reports. Explosives: Development of reactive armour, etc., 4 reports. Explosive pressurizing: Control of boundary surface for multi-layer explosion initiator, etc., 3 reports. Measurement: Booster test with under-water explosion, etc., 6 reports. Ammunition: Test make of large current high speed interrupter switch using an explosive, etc., 6 reports. Totally 66 lectures. Special lecture was made by prof. Itoh of The University of Tokyo on the prospect of technology for the redevelopment of the cities.

5055 (IES—8801, pp 1-2) **Basic research of liquid propellant.** Masaki, Hakobu; Kosaka, Yasunori; Kameyama, Daijiro. (Asahi Chemical Industry Co., Ltd., Nobeoka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 ofthe Industrial Explosives Society, Japan.

Studies on the liquid propellants which had been proceeded since 1940 have recently made rapid progress. Liquid propellant has advantages of continuation of shooting range, decrease of gun erosion, removal of cartridge improvement of safety, cost reduction, etc. Liquid propellant is classified to simple compound type and double compound type. Simple compound propellant is the major line of research in the western countries among which the most popular one is HAN (Hydroxyl Ammonium Nitrate) based propellant with a fuel of aliphatic ammonium nitrate. major stream of a gun system using a liquid propellant is a regenerative system (wherein liquid propellant is continuously dropwise fed) which excels in reproducibility of combustion. It was found that sensitivity of liquid propellant was less than that of raw materials which melted and then thermally decomposed. At this time, combustion temperature gets less because of much water contained in the product formed. Problems left are how to control the combustion and to find the cause of vibrating wave generation. (5 figs, 2 tabs)

5056 (IES—8801, pp 3-4) **Study of liquid propellant (Part 1).** Kuwabara, Takuo; Kosaka, Katsuaki. (Nissan Motor Co., Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 ofthe Industrial Explosives Society, Japan.

Although a liquid propellant reduces the temperature of a gun wall and withholds the fatigue of the gun by injecting or regenerative cooling onto the gun wall, its igniting and combusting characteristics are almost unknown. We, therefore, examined its firing characteristics by using HAN (Hydroxyl Ammonium Nitrate). Liquid drops with approximately 3 mm diameter were dropped using an injection syringe to measure the delay time of ignition; when methanol is mixed in HAN solution, the delay time gets larger (methanol mixing was 10 - 50%). When methanol is added to HAN solution, both chemical and physical delay time are evidently affected; effect of ratio of HAN solution/methanol is that 10/0 is much less than 7/3. As for the thermal decomposition gharacteristics when methanol is mixed, both the weight reduction and the heat generation peak are shifted to low temperature side. (4 figs, 3 refs)

5057 (IES—8801, pp 5-6) **Effect of various iron oxides on combustion velocity of AP/HT propellant.** Ichikawa, Toshio; Tomoki, Masashi; Hagiwara, Yutaka; Ito, Takeshi. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Effect of average particle size of various iron oxides on the combustion velocity of AP/HTPB propellant was examined. A sample of AP 80%/HTPB 20%, made by crushing in a ball mill for 5 min., was added with 7% of a curing agent (IPDI) per HTPB; iron oxide used was alpha-Fe_2O_3 which was crushed in a ball mill. Longer crushing time gave higher catalytic effect and the small particle size gave higher combustion velocity. Detonation treatment enhanced the catalyst effect, reduced the particle size and increased the combustion velocity. When detonation was compared with ball mill treatment, the former gave more catalytic effect than the reduction of the particle size. It also gave the timing advantage. (5 figs)

5058 (IES—8801, pp 7-8) **Study of low temperature nitrogen gas generating agent.** Tsujikado, Nobuo; Ishibashi, Akihiro; Doke, Kiyotaka; Anami, Toshiyuki. (Defence Agency, Tokyo, Japan; Asahi Chemical Industry Co., Ltd., Oita, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Gas generating agent wherein sodium azide and iron oxide powders are press/formed under vacuum to generate nitrogen gas in asurface end combustion mode gives a safe combustion characteristics similar to a solid propellant for rocket. High pressure nitrogen gas of relatively low temperature is continuously generated at roughly 45% yield. The gas generated can be easily cleaned through a minute sintered metal filter because it is neutral. experiment on the reduction of the combustion speed was carried out. Combustion stability on the reaction surface does not change by the addition of any of MnO_2, SiO_2 and TiO_2; yield of the generated gas reduced by the addition of 10%. On the contrary, when $CaCO_3$ is added, main reaction is restricted by its own endothermic reaction, reducing the combustion speed; at 10% addition, the gas generated contained CO_2 without impairing the yield. Best combustion speed was obtained at 50/50 of NaN_3/Fe_2O_3; when $CaWO_4$ is used as an oxidizing agent, the combustion was complete with the combustion speed of 3.2 mm/s. (3 figs, 1 ref)

5059 (IES—8801, pp 9-10) **Two-stage propulsion type rocket motor.** Nishii, Shigeki. (DAICEL Chemical Industries Ltd., Harima, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Recently a two-stage propulsion type rocket motor was invented to improve the overall performance of a rocket motor; consisting of a nozzle and two combustion chamber; respective combustion chambers are charged with different propellants which are combusted at arbitrary time intervals generating two independent thrust impulses. Combustion test and analysis of this system were conducted. The propellant was a composite of ammonium perchlorate (AP) (86%) and end hydroxyl polybutadiene (HTPB) (14%). 20 holes of 5 mm diameter was equipped on a pressure barrier wall which separated the combustion chamber, and ceramic balls of 6 mm diameter were used to close the holes from the first combustion chamber side. After placing the pressure barrier wall, the first stage propellant was combusted, and then the second one after several seconds. As a result of the combustion test, it was found that the ceramic balls completely shielded the combustion gas and heat of the first stage propellant, thus giving proper performances and improving the overall performances. (3 figs)

5060 (IES—8801, pp 11-12) **Production of fine particles of ammonium perchlorate by freeze-drying method (Part 2).** Hagiwara, Yutaka; Tomoki, Masashi; Ichikawa, Toshio; Ito, Takeshi. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Freeze drying is a method to produce fine particles of ammonium perchlorate by directly spraying saturated ammonium perchlorate solution into liquid nitrogen to instantly freeze, and water being sublimed as it is frozen; the particles obtained is an aggregate of particles of 0.5 - 10 micron size, the size of the aggregate being roughly the same as the sprayed droplets. An experiment was done to see if it was possible to produce fine particles of ammonium perchlorate of 1 - 2 micron size when a spray of 1 - 2 micron was used. Ammonium perchlorate was dissolved in distilled water at room temperature to prepare about 12 wt% solution, and, by means of a supersonic type spray unit, it was sprayed into a bath of liquid nitrogen to freeze instantly. Ammonium perchlorate obtained was observed with a scanning type electron microscope; the result showed a scattered location of aggregates of fine particles within the fine particles, average particle size calculated by the value of specific surface area being 1.1 - 1.2 micron. Falling weight sensitivity was ranked at 4; X-ray diffraction showed high crystallinity; high peak temperature of low temperature decomposition. (6 figs)

5061 (IES—8801, pp 13-14) **Wall vibration and sound by in-structure explosion.** Kuroda, Eiji; Tago, Yoshinori; Hayashi, Minoru; Saito, Terumitsu; Kobayashi, Naota; Yoshida, Tadao; Murata, Tamotsu. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan; The Univ.. of Tokyo Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

In order to obtain design information for a capsule type compact magazine, approximate actual scale of a magazine was made by trial wherein various explosion experiments were conducted. Test amount was 4-fold, 30, 100, 200 and 300 kg, and explosion was made in sand, on sand and in hanging conditions. Results of the experiment were as follows: Sound got larger as the charge increased. When a double bar wall and a single bar wall were compared, the latter gave higher sound pressure and noise for a 10 m distance under the sand, and the former gave higher noise in the explosion on the sand and hanging explosion. As for the sound pressure and noise level difference, 30 g in-sand explosion and 300 g hanging explosion were as high as 11 - 130 dB. As for the sound pressure level at double bar wall 1 m point, in-sand explosion gives 10 dB higher than 10 m point; in-air explosion gives 3.4 - 8 dB only, and sound generating at the wall surface. Wall vibration and dominant frequency vary by the explosion source conditions and are concentrated in the ranges 80 - 100 Hz and 300 - 400 Hz. (2 figs, 2 tabs)

5062 (IES—8801, pp 15-16) **Subsoil vibration which accompanies in-water energy test.** Kuroda, Eiji; Mochizuki, Yasuyuki; Kobayashi, Naota. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

By conducting an in-water test of an industrial explosive, subsoil vibration and sound were measured to examine the subsoil vibration characteristics and its mechanism of formation. Explosives used were a slurry-explosive 100 g - 1 kg and NO.2 Enoki Dynamite 100 - 700 g; explosion was made under 5 m in a dammed pond with 30 m (W) and 130 m (L). Test results were as follows: The time between the initial subsoil vibration and the appearance of relatively high amplitude waveform is a little longer than a time between the rise-up of in-water shock wave and the arrival of peak of the bubble pulse; they appear according to the phenomena occurring in the water. As for the wave form of the sound waves measured at the shore, there are two; 2 spikes corresponding to the in-water shock wave and the bubble pulsation emerge at the time corresponding to the bubble period; dominant frequency shows a sharp peak in a frequency range; the inertia movement of the water medium caused by the first bubble pulsation gives rise to a subsoil vibration and sound caused by an explosion under the shallow water. (2 figs)

5063 (IES—8801, pp 17-18) **Basic study on the safety of the underground magazine.** Hasue, Kazuo; Munemasa, Kunihiko; Adachi, Tetsuhiko; Nakahara, Shoji; Kato, Kiyoshi. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Because of difficulty of securing the land, underground magazines tend to replace the on-ground type magazines. By modelling an undergroung magazine, consideration was given on safety for 40 t storage capacity concerning the subsoil vibration and a blast wave. The model magazine cosisted of a cylindrical chamber (30 mm I.D., 40 mm height, 28.3 cm^3 volume) and a passage of 9 mm I.D. and 10 - 50 cm length. Two magazines, a plastic and a steel ones were prepared. The results are as follows: Elastic wave propagation speed and dominant frequency were 275 - 462 m/s and 12 - 110 Hz for the plastic one, and 300 - 576 m/s and 49 - 22600 Hz for the steel one. Sand showed twice as much maximal displacement as sand; plastic magazine was 10 - 20 times higher than the steel magazine, showing the significant influence of the soil type and the magazine material. External blast wave pressure depended on the angle of emission and the material; underground type magazine was as safe as the on-ground type from the subsoil vibration and the external blast pressure. (3 figs, 1 tab, 1 ref)

5064 (IES—8801, pp 19-20) **Examination on deformation of metal plate by detonation wave pipe.** Kuroda, Eiji; Kadota, Shin'ichi; Azumi, Ichiro; Kobayashi, Naota. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

A shock wave pipe to generate a shock wave by utilizing a gas detonation was made, and the response of a metal to the shock-wave, especially an improved blastometer was investigated. Dimension of the shock-wave pipe is 143 mm I.D., 1 m of reaction chamber length and 6 m of total pipe length; fuel was a mixture of propane, oxygen, and air and has a static pressure 0.05 - 8 kg/cm^2. Test was made to measure the incident pressure and the amount of deformation by fixing a cassette of an improved plastometer at the pipe bottom by means of a 0.5 mm thick lead sheet; difference by the curing time of the epoxy resin was not observed, but the use of epoxy resin resulted in less fluctuation of the deformation. The use of copper plates of 0.2 mm and 0.3 mm thickness gave the similar result. Future study will be directed to the improvement of the plastometer performance. (5 figs)

5065 (IES—8801, pp 21-22) **Deformation behavior of beam and cylinder which are subject to an explosion pressure wave.** Itagaki, Haruhiko; Yan, Hsin Mi; Ogawa, Terushige; Nakano, Masashi; Ochi, Koji. (Yokohama National Univ., Faculty of Engineering, Yokohama Japan; Nippon Oil and Fats Co., Ltd., Bibai, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

As a basic study of damages by the dynamic action of explosion pressure wave, 2 types of explosion experiment were conducted, cylinder in water and beam in the air. The results were as follows: Maximum strain was 8 - 10% for a compact cylinder model, 13 - 15% for a large model, 20 mm for a 1.6 mm thick beam, and 10 mm for a 3.0 thick beam. For these models, assuming that the kinetic energy of the pressure received is converted to strain energy, the strain was calculated, and the calculated value was higher than the value measured. When analysis was made by assuming the bending deformation of a beam as one oscillation system of one freedom, both Young's modulus and yield pressure were

larger than the static value, causing less deformation. Conversely, it was found that, by correcting a spring constant and a resistance constant, a dynamic deformation can also be deduced from a static theory. (6 figs, 2 tabs)

5066 (IES—8801, pp 23-24) **Measuremet of blast wave pressure in a field explosive test.** Nakayama, Yoshio; Iida, Mitsuaki; Kuwahara, Nitaro; Ishikawa, Noboru; Yoshida, Masanori; Usuha, Shu; Tsunodate, Yozo; Aoki, Katsutoshi; Tanaka, Katsumi; Fujiwara, Shouzo. (National Chemical Lab. for Industry, Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Blast wave pressure of a moisture-containing explosive G was compared with that of TNT. Explosive source was 500 cartridges of 50 mm diameter x 1 kg for the explosive G, and a cylindrical cast body with 700 mm diameter and 900 mm height; converted explosion height from the center of gravity the sample to the ground surface was approximately 0.17 $m/kg^{1/3}$. For the analysis of a blast wave form, a fitting of the pressure wave form data by using a natural cubic spline function was made; plot was made from the fit of the equation for the impulse of the peak excess pressure and the positive phase pressure against the converted distance, and TNT-converted amount explosive of the moisture-containing explosive G was calculated to be 65 - 85%. Analysis of explosion energy of the moisture-containing explosive by KHT code gave 720 cal/g, and 66% of TNT-converted explosive amount was 66% which well coincided with the result of the experiment. (3 figs, 2 tabs)

5067 (IES—8801, pp 25-26) **Production of a propellant using porous perchlorate (AP) and its combustibility.** Tomoki, Masashi; Ichikawa, Toshio; Hagiwara, Yutaka; Ito, Takeshi. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

By improving the filler effect by ferrous fumalate and the multi-peak distribution, a propellant with high combustion speed (due to the combustion speed accelerating effect of porous AP (PAP) was tried to be obtained without reducing the content of AP. When a propellant was produced only with PAP and binder, PAP content reached only to 62.7% (measured by the height of the casting viscosity); it did not exceed 70% even when catalysts (Fe, F) were added. However, in order to fill the gap between PAP particles, by properly mixing the medium and fine particles of AP (preliminarily crushed and sieved), the PAP content could be increased up to 78%, combustion speed up to above 15 m/s whereas it was 7 - 8 m/s with AP only. At this moment, ratio of PAP and the crushed AP was 0.4. (3 figs, 1 tab)

5068 (IES—8801, pp 27-28) **Combustion mechanism of high energy propellant.** Sonobe, Sunao. (Nippon Oil and Fats Co., Ltd., Aichi. Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Thermal analysis and element analusis were made to examine the combustion mechanism of a propellant using GAP (Glycidyl Azide Polymer), which is a high energy substance, as a binder. Combustion speed of GAP propellant was 2 - 3 times of ordinary double-base propellant; sensitivity to pressure showed asimilar value; DTA, TG measurement showed a heat generating peak at 523K, weight reduction due to heat generation being roughly 42%. Relation between the weight reduction by thermal decomposition and evolved heat of the decomposition product showed 42% of weight reduction without generating heat. At this time, it was found that roughly 70% of nitrogen disappeared and the reaction - $CH_2N_3 \rightarrow -CN + N_2 + H_2$ occurred according to the ultra-red ray analysis. (4 figs)

5069 (IES—8801, pp 29-30) **Progress of combustion of solid propellant with inserted metal wire.** Tanaka, Masafumi; Morisaki, Kenji; Kamesawa, Naohiro; Nagamune, Naruhisa. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Caveny's calculation model with a two-dimensional model was applied to a cylindrical coordinate system to predict the timewise variation of the theoretical combustion rate and the comparison was made with the corresponding experiment. The result is that the combustion speed, both theoretical and experimental, remains steady for a certain period of time after the start of combustion, but begins going up at a certain point, and then returns to stationary state at high speed (r_1). Tau, a time period of continuation at combustion rate r_0, is a preparatory period before the effect of metal wire appears. Relations between Tau, r_1 and metal wire diameter are shown in the figures wherein it is shown that the calculation and measurement roughly coincided in spite of the theoretical model neglecting the chemical process. However, the influence of the reaction layer should be considered in the model, in case the wire diameter is small. (4 figs, 3 refs)

5070 (IES—8801, pp 31-32) **Combustion characteristics of NP (Non Pollution) propellants.** Soya, Tomohiro; Machida, Hideki; Shimizu, Haruaki; Fukuda, Takaaki; Iwama,. (Nippon Oil and Fats Co., Ltd., Aichi, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

In order to replace AP (Ammonium Perchlorate)-containing propellant which generates harmful HCl by decomposition, high energy propellant obtained by adding Al to a non-polluting double-base propellant was examined for its efficiency and characteristics of combustion. Both composition A and composition B which has high specific thrust force by 10 sec showed maximum theoretical value at addition of 20 parts of Al; combustion rate gets reduced by more addition of Al, but the pressure index gets higher; the larger particle size of Al accelerates the reduction of the combustion rate. By experiment, the specific thrust got maximum at 15 parts addition of Al. Composition A did not give difference in the combustion efficiency for the difference of 20 or 30 micron; but, for the same diameter, B was higher than A, and B was improved in particle size from 30 to 8 micron. Combustion efficiency varied by energy level and particle size. (4 figs, 1 tab)

5071 (IES—8801, pp 33-34) **Prediction of vibrating combustion of CDB propellant (part 4).** Miya, Shigenobu; Kanazawa, Teruo; Hanzawa, Masahisa. (Nippon Oil and Fats Co., Ltd., Aichi, Japan; Tokai Univ., School of Engineering, Hiratsuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

In contrast to the motor (fai 80 x 300 L) of the Report 3, a motor (fai 80 x 400 L) was combustion tested and predicted. Composition of the propellant used was NC (45.6%), NG (40.8%), binder (9.6%), others (4.0%), and the prediction showed stability to the vibrating combustion. Therefore, a pressure vibration was forced to be excited by the ignition of squib; the prediction and the test result roughly coincided, validity of the prodiction method being confirmed. By comparing with T-burner test of the double base propellant, CDB propellant was found stable to vibrating combustion when compared with DB propellant which self excited even when the combustion area is small by comparing with T-burner test of double-base propellant. (5 figs, 2 tabs)

5072 (IES—8801, pp 35-36) **Centralized controlled blasting system by MBS.** Tazaki, Yoji; Kurokawa, Koichi; Ueda, Takeo. (Nippon Oil and Fats Co., Ltd., Aichi, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

This report introduces a centralized blasting system from the out-of-the-mines office at Kamioka Metal mines. The system consists of control station (one unit), relay terminal (8 units) and blasting machine (53 units) which are connected with respective terminals. The control station contains a controller which controls the charge, ignition of the blasting machines, a selecter which selects one of the 8 relay terminals and one blasting machine out of the connected 10 (5) units, and an interphone which communicates with the blasting machines. The blasting machines are electromagnetic induction type MBS unit which contains no such power source as a dry battery, and has two master/branch types of unit, each can handle 100 blasts. This system is now daily controlling the periodical blasting of 3 - 4 times for 10 - 12 faces, all being complete and smooth. (1 fig)

5073 (IES—8801, pp 37-38) **Automatic loader field test.** Kawamura, Minoru; Nagata, Tomihiro; Kurokawa, Koichi; Hattori, Katsuhide; Sakano, Ryoichi. (Nippon Oil and Fats Co., Ltd., Aichi, Japan; Taisei Corp., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

A special primer cartridge was derived for solving the problems of the automatic loading, and a field test was conducted. Explosive for a master die uses smaller critical tablet diameter and a titamite with 9 mm diameter and 4300 m/s of blasting speed. For automatic loading spare-dies, titamite in a plastic tube with size and weight 25 mm x 100 g is used. A guide pipe for master die insert is a polycarbonate pipe with O.D. 13 x 1500 mm length, whose tip end is fitted with a wooden tip cone, which easily inserts at the loading density 1.0 g/cm^2, also eliminating the problem of friction static electricity (below 500 V). Loading time was similar to the manual loading, if the time for machine handling, hose removing and matrix die loading is totally calculated. The real merits are the higher loading density and the remote handling apart from the faces in the mines. (1 fig, 1 tab)

5074 (IES—8801, pp 39-40) **Prediction and reduction of vibration and sound of blast by using exactly delayed electric detonator.** Yamamoto, Masaaki; Toyama, Norimitsu; Haraguchi, Yasuhiro; Aiko,Ken'ichi. (Asahi Chemical Industry Co., Ltd., Oita, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Owing to the development of exactly delayed detonators (EDD), the exact superimposition of waves which was impossible by the conventional delay detonator, has become feasible. Consequently, a technical method was established to predict vibrations and sounds, which are considered to be generated during time-differential blasting (staggered blasting) of many holes by EDD, from the wave form of a single blasting measured on the blasting site and to determine the delayed time interval most suitable for making the vibrations and sounds of blasting to be the minimum, Then in order to demonstrate its effectiveness, the on-the-site experiments were conducted. As the results, the prediction of the vertical vibration speed wave form and the vertical low frequency sound pressure wave form at the time of the successive blasting of five holes was compared with the actually measured results on the same scale and any kind of the predicted wave form coincided well with the corresponding measured result. Consequently, it was demonstrated that the above prediction method of vibrations and sounds was very effective for a detonator with exactly delayed time like EDD. (2 figs, 1 tab)

5075 (IES—8801, pp 41-42) **Distribution of detonation energy at the time of blasting.** Yamaguchi, Umetaro; Motegi, Minato. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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The authors of this article previously presented that through blasting experiments using a cement-mortar block and a No.6 electric detonator and from the wave form of the detonation wave measured at the outer circumference of the cement-mortar block as well as the destructed condition of the block, the energy of the electric detonator E was distributed among the energies as shown below: $E=Ev+E\epsilon+Em+Ec$ Ev: energy propagated in the mortar, $E\epsilon$: energy consumed for fracture and cracks of the mortar, Em: energy consumed within the media around the detonator, and Ec: energy consumed for such phenomena as heat and sound, etc.. This time, from the acceleration wave form of the detonation wave which was observed from the above experiment, the equation $Ev=4\pi r^2 e(r)$ was obtained in order to obtain quantitatively the energy of the detonation wave. In the above, r is the distance from the source of blasting and e(r) is the energy density. (3 figs, 1 ref)

5076 (IES—8801, pp 43-44) **Spectrometry of cylindrically converging detonation. Explosion, combustion and decomposition (Part 1).** Nagumo, Yoshiro; Okamoto, Keishi; Koshi, Mitsuo; Matsui, Hiroyuki. (The Univ, of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Since old days, studies have been made on converging gas detonation and concerning combustible premixed gas, cylindrically converging detonation waves with fairly excellent symmetry can be made with a relatively simple device. In this report, with respect to acetylene-oxygen premixed gas, observation was conducted on converging detonation waves which had convergence of radius of 0.2mm or less using singleframe pictures with enlarged central portions taken with an ultra high speed image converter camera. In addition, a significant acceleration was observed for the first time in the vicinity of $t=-1\mu$spc near the center and was found to develop to an excessive detonation. The temperature of the central portion after the convergence was estimated to have reached fairly high. It was also revealed, inter alia, that a nucleus accompanying lasting strong radiation existed only around the center of symmetry. This article summarized the results of the observation and study on the aforementioned behavior of the central portion mainly by spectrometry. (3 figs, 1 tab, 1 ref)

5077 (IES—8801, pp 45-46) **Mathematic calculation of initiating process by attenuating shock wave. Acid-hydrogen based gas.** Tamaki, Shinkichi; Miyoshi, Akira; Koshi, Mitsuo; Matsui, Hiroyuki. (Kinki Univ., Faculty of Science Tech., Higashi-Osaka, Japan; The Univ. of Tokyo, Faculty of Engineering, tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Heretofore, experiments concerning direct initiation of various premixed gas and oxygen based gas by attenuating shock waves have been conducted. In this report, in order to try to make the detailed theoretical explanations of the results of the above experiments, the acid-hydrogen based gas was chozen as the subject for study, the conservation equation of the one-dimentionally reactive fluid was solved in such way as incorporating many elementary reactions, and how the attenuation factor of the shock waves and the initial pressure, dilution as well as composition, eic. of the mixed gas contribute to the initiating process was examined. As the results, it was found that the critical detonation mach number of the shock wave initiation of the acid-hydrogen based gas by the attenuating shock wave could be explained very well by the calculation of the one-dimentionally reactive fluid taking into consideration the elementary process which was done this time. (4 figs, 1 ref)

5078 (IES—8801, pp 47-48) **Flame propagation and explosion pressure at the time of gas explosion inside simulated head way.** Itagaki, Haruhiko; Goto, Yasuhiro; Ogawa, Terushige; Nakano, Masashi; Ochi, Koji. (Yokohama National Univ., Faculty of Engineering, Yokohama, Japan; Nippon Oil and Fats Co., Ltd., Bibai, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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When a gas explosion occurs in an unidimentional space such as head way or tunnel, such explosion changes to detonation if a combustible mixed gas layer with a distance not less than a certain value exists. Actual explosion accidents normally assume a form that combustible mixed gas is formed in the above space and develops to be ignited and exploded. Accordingly, in this report, a gas explosion experiment of the above form in a simulated head way was conducted and flame propagation and explosion pressure were measured. The simulated head way used was a 7.8m long cylindrical pipe of a diameter of 1.2m. One end of the pipe was tightly closed and a wrapping kraft paper partition was set at the point of 2.1m from the closed end to make the source of explosion and the methane (concentration:10Vol%)-air mixture was formed therein. The simulated head way of this experiment had a ratio between diameter and length which was different from the existing head way, consequently the data obtained from the experiment is difficut to apply, but if experimental data obtained by using a small model with a different ratio between diameter and length is used, practical estimation is feasible. (6 figs)

5079 (IES—8801, pp 49-50) **Combustion behavior of reactive material observed by the visible time-pressure method and its analysis.** Miyazaki, Shigefumi; Kosaka, Katsuaki; Ishida, Eiji; Ito, Aoi; Tamura, Shozo; Yoshida, Tadao. (Nissan Motor Co., Ltd., Tokyo, Japan; The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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As a method to investigate combution danger in an enclosed system when ignition energy is given to reactive material, a modified time-pressure (P-T) testing device was experimentally manufactured and the application of the existing standard testing conditions, oxidant-combustible based compounds, explosives and organic peroxide, etc. to the assessment of combustion danger have been examined. In this report, using the visible T-P device, the combustion phenomena in case when ignition energy was given to reactive material was observed and from its combustion behavior, the characteristics of the T-P method as a method of assessing combustion danger were examined. A chamber made of quartz was used so that the combustion phenomena of reactive material might be observed. Observations were made on the combustion behavior of single material (ALBN, DPT) and the $KClO_3$/cellulose mixture based material and information and knowledge on combustion speed, etc. were obtained. (3 figs)

5080 (IES—8801, pp 57-58) **Basic research for the development of explosion-proof sheet (Part 3). Simulated experiment of tunnel blasting.** Tanaka, Mitsuru; Mizuno, Keizo; Aiga, Yutaka; Fukushima, Tadashi; Nakamura, Shigeyuki. (Taisei Corp., Tokyo, Japan; The Japan Carlit Co., Ltd., Yokohama, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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At the pit for experiment in the Hodogaya plant of Nihon Carlit KK, tunnel blasting was simulated and a basic research was conducted with regard to the flight condition of flying stones at the time of tunnel blasting, suppression of flying stones as well as relaxation of blast waves by explosion-proof sheets and the dynamic character of the explosion-proof sheet, etc. As explosion-proof sheets, two kinds of alamide fiber based material and one kind of polyethylene fiber based material were used. As the results, the following conclusions were, inter alia, obtained: 1) Explosion-proof sheets suppress flying stones completely: 2) The relationship between elongation and tension of explosion-proof sheets at the time of blasting agrees the result of tension tests of the sheet film material concerned; 3) The displacement of the explosion-proof sheet actually measured almost coincides with the calculated value of the proposed formula; 4) The blast wave measured in the pit almost coincides with the calculated value of the proposed formula; 5) The blast wave in case of installation of explosion-proof sheets is 1/4 of the wave in case of non-installation and sheets relax the blast wave considerably. (5 figs, 3 refs)

5081 (IES—8801, pp 59-60) **Basic research for the development of explosion-proof sheet (Part 4). Research results and future prospect concerning its field of utilization.** Aiga, Yutaka; Tanaka, Mitsuru; Mizuno, Keizo; Fukushima, Tadashi; Nakamura, Shigeyuki. (Taisei Corp., Tokyo, Japan; The Japan Carlit Co., Ltd., Yokohama, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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The aims of the development are, inter alia, 1) prevention of flight of sand and stone occurring with a blast, and 2) prevention of diffusion of gas and dust after the blast. For an explosion-proof sheet, aromatic polyamide fiber was used. From the results of the basic research, it was demonstrated that the sheet could stop the blast wave and flying stones gently. Concerning the structures of explosion-proof sheets, there are two kinds, namely the pit structure like tunnel, etc. and the sheet structure for urban blasting and blasting for entry of the light, etc. As the future prospect of its usage, such fields of utilization as protection of equipment, structures and temporary constructions are now in consideration. (1 tab)

5082 (IES—8801, pp 61-62) **Thermal ignition behavior during the storage of organic peroxide.** Murata, Shigemi; Nabeshima, Jyoji; Itagaki, Haruhiko; Ogawa Terushige; Suyama, Shuji; Sakai, Hiroshi. (Yokohama National Univ., Faculty of Engineering, Yokohama, Japan; Nippon Oil and Fats Co., Ltd, Aichi, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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By using organic peroxide, bisperoxidicarbonate as sample, vacuum stability tests, adiabatic storage tests, isothermal storage tests and measurements of heat conductivity were conducted and the effects of different grain sizes on the thermal stability were investigated. As the results, both the vacuum stability tests and the isothermal storage tests revealed that the larger the grain of peroxidicarbonate was, the more active it was, but the more instable thermally and timewise it was. The adiabatic storage tests did show no difference in the heat generation rate. (5 figs)

5083 (IES—8801, pp 65-66) **Heat stability of organic peroxide (part 3).** Jinnai, Takanori; Hara, Yasutake; Nakamura, Hidetsugu; Suyama, Shuji; Sakai, Hiroshi. (Kyushu Inst. of Tech., Faculty of Engineering, Kitakyushu, Japan; Nippon Oil and Fats Co., Ltd., Aichi, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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By using benzoyl peroxide and its various substitution products as samples, a comparative study was made on its thermal decomposition reactions. Concerning thermal reactivity, samples were classified into those which started decomposition from low temperatures and showed relatively gentle heat generation and those which showed instant heat generation from a certain temperature. With regard to the ignition temperature measurement, no ignition due to heating was observed and only the generation of white smoke accompanying decomposing sounds was observed. Concerning decomposition speed, those whose decomposition progressed in solid phase showed the autocatalysis type reaction and those whose decomposition progressed in liquid phase, the n-dimention type reaction. (4 figs, 1 tab)

5084 (IES—8801, pp 65-66) **Reaction between ammonium nitrate and aluminum.** Kamo, Kenji; Miyake, Daiji; Nakamura, Hidetsugu; Hara, Yasutaka; Kato, Kazunari. (Kyushu Inst. of Tech., Faculty of Engineering, Kitakyushu, Japan; Nippon Oil and Fats Co., Ltd., Aichi Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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A comparative study was conducted on the effects of adding various additives to the ammonium nitrate (AN)-aluminium (Al) mixture aiming at increasing combustibility of Al. 1) Thermal reactivity of AN-Al mixture: When the reagent aluminium and the pigment aluminium were compared, it was revealed that the latter was more reactive and its reactivity varied depending upon its kinds. 2) Thermal reactivity of AN- magnum mixture: At any composition ratio, a big exothermic reaction occurred and a violent reaction was made with Al. 3) Effect of addition of halide on the thermal reactivity of AN-Al mixture: In case of fluorine compounds such as LiF and NaF, the calorific value was big and Al was oxidized. (3 figs, 1 tab)

5085 (IES—8801, pp 67-68) **Statistical analysis of the results of static electricity sensitivity tests.** Takeyama, Shozo; Kuroda, Eiji; Nagaishi, Toshiyuki. (Kinki Univ., Faculty of Science Tech., Higashi-Osaka, Japan; Kyushu Sangyo Univ., Faculty of Engineering, Fukuoka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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A static electricity sensitivity tester using the approaching electrode method was designed and manufactured and tests were conducted by using it on zirconium under various static electricity circuit conditions. The results were as follows: 1) Probit analysis of the results of static electricity tests; It was found that the 50% point which was measured as the static electricity sensitivity of zirconium fluctuated depending upon the static electricity circuit conditions and as the general trend, the sensitivity tended to be measured less sensitive as resistance and condenser became larger. 2) Double regression analysis concerning the 50% point; The resistance between the resistance value of 0 and that of 20k was accidental in comparison with the resistance obtained from the tests using other resistance values. (3 figs, 2 refs)

5086 (IES—8801, pp 69-70) **Sensitivity of ingredient material for explosives (Part 5). Electrostatic sensitivity of mixtures of zirconium and oxidizing agents.** Nagaishi, Toshiyuki; Kuroda, Eiji. (Kyushu Sangyo Univ., Faculty of Engineering, Fukuoka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Electrostatic sensitivity was studied for the mixtures of zirconium and some oxydizing agents. Experiments were conducted according to Standard of Association of Industrial Explosives, E-26, under open condition as defined in it. Oxydizing agents used were potassium perchlorate, potassium chlorate and potassium nitrate. Mixing ratio of zirconium with oxydizing agent versus energy of 50% ignition are correlated by graphs. In case of Zr-KNO_3 mixture, 40-50% of Zr content gave the highest sensitivity. In case of Zr-$KClO_3$, the highest sensitivity was shown at 37.5 pF of electrostatic capacity. In case of Zr-$KClO_4$, stable high sensitivity was given within the range of 0-70% of $KClO_4$ content. (fig 4)

5087 (IES—8801, pp 71-72) **Sensitivity of ingredient material of explosives (Part 6). Electrostatic sensitivity of zirconium hydride mixtures.** Kuroda, Eiji; Nagaishi, Toshiyuki. (Kyushu Sangyo Univ., Faculty of Engineering, Fukuoka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Electrostatic sensitivity was measured for the mixtures of zirconium hydride with oxydizing agents. Experiments were conducted by the method as defined in ES-26. 3 systems of ZrH_2-KNO_3, ZrH_2-$KClO_4$, ZrH_2-$KClO_3$ and pure ZrH_2 were used for the experiments. Mixing ratio of ZrH_2 versus energy of 50% ignition were correlated as graph. As the result, it was learnt that the higher the mixing ratio of oxydizing agent, the lower sensitivity was obtained and that oxydizing agent could be regarded as de-sensitizer. (5 figs)

5088 (IES—8801, pp 73-74) **On the reactivity of explosives to Co_2 laser.** Hasue, Kazuo; Kono, Hitoshi; Nakahara, Shoji; Sato, Heihachi. (The National Defense Academy, Yokosuka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Observation was conducted to the reaction of explosives induced by irradiation of CO_2 laser beam. Explosives were loaded by compression in a case made of acrylic resin. Ignition time was measured by using a video camera. Ignition time versus laser beam flux density were correlated as graph. As the result, it was understood that explosive powders could be classified into three groups of long ignition time type, short ignition time type and intermediate type. Effect of laser beam absorbing agent were studied and it was recognized that, within certain limit of addition, active carbon was effective to shorten ignition time. (3 figs, 1 tab)

5089 (IES—8801, pp 75-76) **Small scale gap test in water.** Matsunaga, Takehiro; Wada, Yuji; Ryo, Ron Hai; Kaneko, Yoshiaki; Hosoya, Fumio; Yoshida, Tadao. (National Chemical Lab. for Industry, Tsukuba, Japan; The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Impact sensitivity of some explosives were studied by applying small scale gap test in water. In this test method, polyethylene plate of various thickness was inserted as gap between No. 0 detonator and test sample. Series of tests were conducted for checking whether the sample was exploded or not. Samples used for the experiments were TNT and PETN, diluted water. Experiments were conducted by increasing the thickness of polyethylene plate until explosion was stopped by the gap. In case of PETN, explosion did not occur beyond 18 mm gap for pure PETN, 4 mm for 10% diluted with water, and 2 mm for 20% diluted, no explosion for 30% diluted. In case of pure TNT, 5 mm thickness stopped explosion. From the result, this method was considered as reliable and safe for measuring impact sensitivity. (3 figs)

5090 (IES—8801, pp 77-78) **Impact sensitivity of potassium nitrate-red phosphorus mixture by falling ball method.** Yoshida, Tadao; Yoshizawa, Nichiroku; Tamura, Shozo; Kaneko, Yoshiaki; Tanaka, Noriaki; Ryo, Ron Hai. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Sumitomo Chemical Co., Ltd., Osaka, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Impact sensitivity was measured for the mixture of potassium nitrate and red phosphorus by falling ball method. Experiments were conducted by using 5 kinds of ball defined in JIS. Direct and indirect tests were compared. By using the test result, falling height versus ratio of ignited samples were correlated using a graph. in case of direct test, the mixtures were ignited with smaller energy than indirect test. Complete mixture and contact mixture were compared and it was concluded that contact mixure which was safer for mixing could be used as the substitute of complete mixture for this test. (1 fig).

5091 (IES—8801, pp 79-80) **Development of reactive armour (part 2).** Sato, Jun; Ito, Takeshi. (The National Defence Academy, Yokoska, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Effectiveness of reactive armour was tested by using RDX/HTPB explosive. Experiments were conducted by observing hardness, by measuring sensitivity and ignition temperature, of the explosive mixtures. Composition of the mixture was varied by step of 5% between 80% and 55% of RDX content. Mixtures between 70% and 65% of RDX had enough flexibility even after hardening. Sensitivity was sharply increased for the composition of lower than 60% of RDX. Ignition time versus temperature for various compositions were correlated using a graph. Explosion tests were conducted by using mixtures of 70% and 65% of RDX. Mixture of 65% RDX showed deeper penetration. (3 figs, 1 tab, 1 photo)

5092 (IES—8801, pp 83-84) **Water containing explosive for big diameter use.** Sunakawa, Tomoji; Fujita, Koichi; Kodama, Taro; Suzuki, Masahiro; Ono, Naoki. (Asahi Chemical Industry Co., Ltd., Oita, Japan; Mitsubishi Mining and Cement Co., Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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This is a report concerning the design and experiment of water containing explosive which can be used as a substitute of ANFO. As the water containing explosive, slurry type was taken which consists of ammonium nitrate and monomethyl amine as main components and density of which was more than 1.2, explosion speed 4880 m/s, F value 7790 atm*L/Kg. Experiments were conducted for variuous loading length. From the result, it was recognized that at least 4.5 m of loading length was neccessary for achieving better result than the case whlen only ANFO was used. (1 fig, 1 tab)

5093 (IES—8801, pp 85-86) **Stability of emulsion type explosives.** Tanabe, Yoshio; Sono, Yoshiyuki; Ikeda, Yoshiyuki. (Nippon Kayaku Co., Ltd., Yamaguchi Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Effects of storing temperature and particle diameter of emulsion on the stability of emusion type explosives were studied. As the emulsion type explosive, ammonium nitrate-sodium nitrate system added by water and petroleum wax was used. Four sizes of particle diameter between 1.7 and 0.75 micron were taken. The explosives were stored for one year under the various temperature levels between -20°C and 70°C with periodical checking of initiating sensitivity at -10°C. The experimental result shows that the stability of emulsion type explosive was affected by storing temperature and composition of carbon fuel, the higher the storing temperature, sensitivity decreased more rapidly, and that particle diameter of emulsion affected seriously on the stability. (5 figs, 3 tabs)

5094 (IES—8801, pp 87-88) **Control of bonded layer surface wave for explosive bonded multilaminate.** Sotomoto, Kazutuki; Fujita, Masaharu; Ran, Lee Chuin; Urakami, Susumu; Chiba, Subaru. (Kumamoto Univ., Faculty of Engineering, Kumamoto, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Experiments were conducted for controlling bonded layer surface wave by applying numerical analysis, and neccessary conditions for obtaining homogeneous wavy surface were established. For the experiment of explosive bonding of multilayer, a driver plate was set above the multilayered metal plates, and powder explosive was loaded above the driver plate. Speed of the driver plate was measured and microscopic photograph of bonded surface was taken. It was considered that speed of driver plate was affected by its weight, that wave length calculated by Hassani's equation was correlated with the thickness of metal plate, and that, in case of multilayer bonding of metal plates of different materials, homogeneous wave length was obtained by using plates of same weight. (4 figs, 1 tab)

5095 (IES—8801, pp 89-90) **Generation of high density plasma by using explosive.** Tsunodate, Yozo; Usuha, Kuni; Yoshida, Masanori; Aoki, Katsutoshi; Tanaka, Katsumi; Fujiwara, Shuzo; Mitamoto, Masahiro; Morita, Akira. (National Chemical Lab. for Industry, Tsukuba, Japan; Fuji Electric Corporate Research and Development Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Properties of plasma generated by explosion was studied. For the experiment, liquid type explosive was used. As booster, combination of tetryl, PETN and silicon rubber was applied. Argon was compressed to plasma by shock of explosion and ejected into polycarbonate tube with high speed. By installing a permanent magnet, velocity of plasma was calculated from electro-motive force generated vertically both to magnetic field and to velocity of plasma. The same method was applied to measure electric current and electro-conductivity of plasma. Those data versus time were shown as graphs. It was considered that ratio of shock wave speed to plasma speed was 30% bigger than that of ideal gas and this was understood as the effect of ionization, and that pressure of plasma was 1.3 Kbar which was nearly equal to the figure of ideal gas calculated from Mach number. (4 figs)

5096 (IES—8801, pp 93-94) **Thermal analysis of initiating explosives.** Iida, Mitsuaki; Oinuma, Senzo; Kuwahara, Nitaro; Nakayama, Yoshio; Ishikawa, Noboru; Tanaka, Kazumi. (National Chemical Lab. for Industry, Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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This is a report concerning results of thermal analysis of 6 kinds of initiating explosives. It was recognized that correlation existed between ignition temperature and decomposition temperature by DSC but did not between heat of formation and heat of decomposition by DSC. For the comparison with cited data, activation energy was calculated by analyzing DSC curve. It was considered that different analytical method of DSC curve gave different activation energy for the reasons of time lag of temperature change and sharp change of temperature of the test sample caused by exothermic reaction. (1 fig, 1 tab)

5097 (IES—8801, pp 97-98) **Estimation of thermal resistance and explosive performance of nitro compounds by using SC-DTA.** Hosoya, Fumio; Kaneko, Yoshiaki; Yoshizawa, Fuchiroku; Tamura, Shozo; Morisaki, Shigeru; Yoshida, Tadao. (Nippon Kayaku Co., Ltd., Yamaguchi Japan; The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Concerning nitro compounds, neccessary conditions were studied as thermally resistant explosive. Experiments were conducted by applying scanning type differential thermal analysis (SC-DTA). By applying integration calculation to data obtained, decomposition temperature, heat of decomposition were calculated. It was considered that chemically stable materials were derivatives of tri-nitro benzene with stable substituent. By studying relation between decomposition temperature and heat of decomposition as shown graphically, it was deduced that tri- and di- nitro compounds propagated explosion but mono-nitro compound did not. (1 fig)

5098 (IES—8801, pp 99-100) **Boosting test with explosion in water.** Wada, Yuji; Matsunaga, Takehiro; Tamura, Shozo; Yoshida, Tadao; Kimura, Ayumu; Kaneko, Yoshiaki; Yoshida, Nobuo. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Nippon Kayaku Co., Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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To investigate whether substances with weak detonation or strong deflagration properties have the nature of explosion propagation, energy generated by explosion in water was measured by tests on variable-quantity specimens. The results were as follows: (1) 31/38 polyvinyl chloride tube test: AIBN (100%), Perbutyl IF (100%), and Kayahexa YD (100%) had no boosting nature. (2) 30/40 steel tube test: DNT boosted at 90% or more and did not boost at 80%. AIBN (100%) did not boost. Perbutyl IF boosted at 80% or more and did not boost at 70%. (3) 50/60 steel tube test: BPO (diluted in water) boosted at 90%, stopped boosting at 80%, and did not boost at 70%. AIBN (100%) did not boost. Perbutyl IF did not boost at 70% and boosted at 80%. It has also been revealed that the results above are not always true when the quantity of the primer is different.

5099 (IES—8801, pp 101-102) **Boosting limit of reactive substance.** Ryo, Ron Hai; Muranaga, Kotaro; Tanaka, Noriaki; Wada, Yuji; Tamura, Shozo; Yoshida, Tadao. (Sumitomo Chemical Co., Ltd., Osaka, Japan; The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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To find limit-boosting substances, 50/60 steel tube tests were conducted through explosion in sand or water. The results are as follows: (1) The specimen explosive was diluted in alumina or water. The limit boosting of this substance was as follows: For DPT and DNT, the concentration beyond which boosting occurred was 70% to 80%; for ammonium nitrate, it was 90% to 100%; for Perbutyl IF, it was 60% to 70%. (2) Mixtures of oxides and inflammable substances showed a strong boosting. However, some substances, including a mixture of crystal potassium (75%) and fine wood particles (25%) and a mixture of crystal potassium perchlorate (40%) and coarse wood particles (60%), did not boost under some condition of ground particle size and mixture ratio. (3) It has been revealed that boosting and DSC data are in some relation according to the results of analysis concerning that relationship. (1 fig)

5100 (IES—8801, pp 103-104) **Evaluation of performance of granular gunpowder using MK3 ballistic mortar.** Muranaga, Kotaro; Kunitomo, Shigeaki; Wada, Yuji; Tamura, Shozo; Yoshida, Tadao. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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To study methods for evaluating the performance of grain gunpowder, various measurements were conducted using three grain gunpowder specimens A, B, and C whose compositions were almost the same, but whose grain sizes were different -- A was slightly finer than B and C was coarse -- and gunpowder (P). (1) Time/pressure test: The powder specimen is three times faster in explosion than the grain specimens, but the three grain specimens cannot be distinguished from each other. (2) For sensitivity to shock, A and B are equal; C is somewhat less sensitive; P is still less sensitive. (3) Firing power test: The sequence of power is A, B, P, and C -- clear distinction. (4) For ignitability, there is no significant difference between A and B, and C is slightly easier in ignition than the other specimens. From the above results of experiment, it has been revealed that power tests using a ballistic mortar with fusehead ignition are of help to evaluate the performance of gunpowder specimens with different grain sizes. (2 figs, 2 tabs)

5101 (IES—8801, pp 105-106) **Testing variable detonating agents for shock sensitivity using explosion in water.** Kaneko, Yoshiaki; Kimura, Ayumu; Yoshida, Nobuo; Tamura, Shozo; Yoshida, Tadao. (Nippon Kayaku Co., Ltd., Yamaguchi,Japan; The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Study was conducted for a method of determining the shock sensitivity of nonsensitive chemical substances by estimating the composition of the exploded specimen from the wave energy of explosion in water. The results of a variable detonating agent test using an MKIII ballistic mortar were compared with the results of a variable detonation test using explosion in water. The results were the same. Also, the ratio between the net swing recorded during the ballistic mortar test and the bubble energy (Eb) obtained through in-water explosion varied depending on the nature of the explosive; this ratio is lower when the substance has a higher explosion speed. (2 figs, 2 tabs)

5102 (IES—8801, pp 107-108) **In-water explosion gas sphere of detonating agent.** Tanaka, Kazumi; Nakayama, Yoshio; Oinuma, Senzo. (National Chemical Lab. for Industry, Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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As part of activities for developing medical pyrotechnics using an extremely small amount of detonating agent, experiment and measurement were conducted to study the minimum amount of detonating agent that can complete explosion. The findings are as follows: (1) Measurement of time-dependent changes in the intensity of the light involved in explosion: When a fusehead was used for initiation, all the detonating agent did not always react at the time of ignition; re-ignition occurred on the unreacted substance when the gas contracted; the light emitted at this re-ignition was observed. Recording was also successful for the ignition process of a detonating agent almost all of which reacted at ignition and emitted weak light at contraction because of the adiabatic compression of the generated gas. (2) In-water explosion power test: It has been revealed through the analysis of measurement results that the formula governing the relationship between the gas sphere radius and pulsation period holds not only for ordinary explosives, but also for special explosives which generate a low amount of generation. (1 fig, 1 tab)

5103 (IES—8801, pp 132) **In-water explosion behavior of columnar charge.** Yoshida, Tadao; Matsunaga, Takehiro; Wada, Yuji; Tamura, Shozo; Hosoya, Fumio; Kaneko, Yoshiaki; Ryo, Ron Hai. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Nippon Kayaku Co., Ltd., Yamaguchi Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Shock waves involved in in-water explosion generate complex interaction. An experiment of exploding columnar charge in water was conducted; it has been revealed through measurement that a shock wave at a speed of 2000 m/sec or more generated by a detonation wave propagating in the explosive gets ahead of the previous wave while propagating in water. The same measurement has proved that the following two techniques can be used to estimate the charge diameter limit for boosting. (1) Columnar charges with various diameters and water contents and a fixed length of 40 cm are exploded in water; the shock waves from this explosion are measured to judge whether boosting proceeds for is interrupted, from the waveform width and shock wave energy. (2) Considering the fact that when boosting is interrupted, the bubble energy does not increase with the charge length, columnar charges with varying lengths are exploded in water, and the bubble energy from this explosion is measured. (2 figs)

5104 (IES—8801, pp 111-112) **Explosion sound from structure firing.** Kuroda, Eiji; Okitsu, Toshihiro; Futase, Kaoru; Hayashi, Minoru; Koide, Kohei; Kobayashi, Naota; Saito, Terumitsu. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Results of measurement of explosion sound from small-scale firing are presented. The purpose of the experiment is as follows: (1) Determining loudness of the sound from stick or drill firing using a small amount of explosive. (2) Determining the influence of the structure on the generated explosion sound and its characteristics. The sound level and sound pressure at each point were measured. Measurement results are still to be analyzed to identify the source of the sound measured at each point and study other factors. (1 fig, 5 tabs)

5105 (IES—8801, pp 113-114) **Very low frequency sound from explosion of large-amount explosive.** Kuroda, Eiji; Tago, Yoshinori; Mochizuki, Yasuyuki; Murata, Tamotsu; Kobayashi, Naota; Fujiwara; Shuzo. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan; National Chemical Lab. for Industry, Tsukuba, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Very low frequency sound generated by the explosion of as much as 500 kg explosive was measured and studied. This experiment was successful because abnormal propagation due to the atmospheric temperature from the ground surface or special changes in wind condition was observed. Also, the characteristics of the very low frequency sound from the explosion of much explosive and its influence on resident houses were also studied. It has been revealed that the prevailing frequency of the sound is 500 Hz or less outdoors, but that the sound changes to louder noise indoors. (2 figs, 2 tabs)

5106 (IES—8801, pp 115-116) **Extinction of explosion sound with foam covering.** Wada, Yuji; Tamura, Shozo; Yoshida, Tadao; Kobayashi, Naota; Ryo, Ron Hai; Ohashi, Masamitsu; Kunikawa, Akiteru; Hashizume, Kiyoshi. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Considering that foam can be used as a new sound damping agent because it can be held on simple structures like nets, the sound damping effect of foam was measured. When one No. 6 detonator was exploded, the sound damping effect of foam was about 20 dB when the foam thickness was 1 m and about 50 dB when it was 2 m. This means that when about 25 grams of explosive is exploded, a foam with a thickness of 2 m have a sound damping effect of 40 dB or higher. When compared with sand covering, foam covering is of great help as a means for noise damping except that foam covering is of little use for preventing scattering objects from entering the inside. (1 fig)

5107 (IES—8801, pp 117-118) **Extinction of explosion sound with snow covering (part 1).** Kuroda, Eiji; Wada, Yuji; Hayashi, Minoru; Koide, Kohei; Kobayashi, Naota; Yoshida, Tadao. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan; Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Experiment of damping explosion sound using snow was conducted. The following findings were obtained regarding the relationship between the snow covering radium (r) and sound level (S). (1) In the range of r from 20 cm or more, S drops by 9 dB when r is doubled; in the range of r from 20 cm or less, such a significant change is not observed. (2) Snow was put into a polyethylene bag with a diameter of 10 cm, and the sound damping effect of the bag with snow was measured; the sound damping was 4 to 10 dB. (3) The sound damping effects of sand and snow were compared. When 20 to 25 grams of explosive was covered with 20-cm thick sand or snow, S dropped by about 30 dB in either case. (4) The dependence of S on explosive quantity with snow covering was measured. When the explosive quantity was increased 10 times, the increase in S was about 30 dB, which is much greater than the S increase involved in increasing the explosive quantity 10 times without snow covering --9 dB. When sand covering was used, the S increase involved in increasing the explosive quantity by 10 times was about 13 dB, which is higher than with snow covering. (4 figs)

5108 (IES—8801, pp 119-120) **Extinction of explosion sound with sand covering.** Yoshida, Tadao; Wada, Yuji; Saito, Terumitsu; Kobayashi, Naota; Kurokawa, Koichi; Hashizume, Kiyoshi. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Experiment was conducted to study the sound damping effect of sand covering. (1) When 100 grams of explosive covered with 30 cm sand was exploded in semi-open environment, the sound level at a point 30 m away from the place of explosion was reduced to about 80 dB (A). (2) The distance damping produced a noise damping effect of about 40 dB. (3) When the quantity of explosive was as low as 10 to 100 grams and a 20 cm sand covering was used, the S increase involved in increasing the explosive quantity twice was 12 dB, but this increase rate rose with the explosive quantity. (4) Measured values varied depending on the environment of the measuring point. (5) It has been revealed that when a columnar explosive is used for cutting reinforcement, force other than Neumann jet applies. It has also been revealed that when a steel sheet is cut, there should be no solid material behind the place of cutting and that internal charging is of help when H beams are exposed. (4 figs)

5109 (IES—8801, pp 121-122) **Fabrication of large-current, high-speed switch using explosive.** Usuha, Kuni; Kadodate, Yozo; Yoshida, Masanori; Aoki, Katsutoshi; Tanaka, Katsumi; Fujiwara, Syuzo; Miyamoto, Masahiro. (National Chemical Lab. for Industry, Tsukuba, Japan; Fuji Electric Corporate Research and Development Ltd, Kawasaki, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Experiment was conducted to study the cut-off characteristics of a large-current switch. (1) Three test switches were fabricated, and time-depending changes in switch current were measured. As a result, it has been revealed that the electric insulation of the combustion gas is not so influential; it raises some difference in deformation speed, but always gives similar cut-off characteristics. (2) The deformation of Al sheets was analyzed through two-dimensional Lagrangian fluid calculation using two types of explosive. The results have revealed that the power of the explosive is likely to greatly influence the current cut-off characteristics just after the starting of deformation. (3) The graph representing the time-dependent changes in switch voltage and resistance calculated from the current waveform and circuit constants suggests the occurrence of arcing. It has been revealed from the above that it is necessary for quickening current cut-off without changing the switch shape to increase the power of the explosive or use a high-impedance material for the seat. (4 figs, 1 ref)

5110 (IES—8801, pp 123-124) **Fuse explosion type detonater using PETN.** Kadodate, Yozo; Usuha, Kuni; Yoshida, Masanori; Aoki, Katsutoshi; Tanaka, Katsumi; Fujiwara, Syuzo. (National Chemical Lab. for Industry, Tsukuba, Japan; Asahi Chemical Industry Co, Ltd., Oita, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

Two types of experiment where detonators were exploded without igniting explosives using a large-current fuse were conducted. The results are as follows: (1) The detonators were ignited individually, and the jitter was measured. When the current rising gradient (dI/dt) was 0.24 to 0.29 A/μs, four out of eight detonators were not exploded, and the error (Δtd) was large. When it was 0.5 kA/μs or more, dt was within 0.1 μs; When dI/dt approached to infinite, t tended to approach to 8 μs. (2) The same bridge current

was flowed through many detonators to check for simultaneous explosion. The delay time (td) was estimated to be about 2 kA/μs; dt was within 0.1 μs. The practical requirements are thus satisfied. The value of dI/dt is almost the same as when measured in a small area. (5 figs, 1 ref)

5111 (IES—8801, pp 125-126) **Precise delay detonator (PDD) (Part 4).** Kusaka, Yasuhiro; Ochi, Koji; Nakano, Masashi. (Nippon Oil and Fats Co., Ltd., Bibai, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

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Field experiment was conducted to study multiple-stage firing with precise delay detonators (PDD) and multi-stage firing with second-order accuracy. The results are as follows: (1) Strip mining field test: The maximum muck size was about 6 m in diameter when DS firing was used, but was as small as 2 to 2.5 m in diameter when PDD firing was used. (2) Land preparation field test: The expected effect of explosion was achieved in both DS firing and PDD firing. The quantity needed for crater cut using PDD firing was calculated; the results showed that C was 0.15 or so; this means that the crushing effect obtained by PDD firing is comparable to that obtained by DS firing. Firing vibration was compared between simultaneous 4-detonator DS firing and PDD firing. The quantity of explosive per stage was 0.9 kg for PDD in contrast to 3.5 kg for DS; therefore, vibration speed is considerably lower in PDD than in DS. No significant difference was found between PDD and DS when comparison was made in reduced distance and vibration speed. (4 figs, 2 tabs)

5112 (IES—8801, pp 127-128) **Safety of electric detonator against radio wave.** Yoshida, Nobuo; Kimura, Wataru; Doi, Kengo; Hashizume, Kiyoshi. (Nippon Kayaku Co., Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

It is said that electromagnetic radiation, static electric field, and induced electromagnetic field are present in the extreme vicinity of a low-power transmitter. The danger of electric detonator explosion at a distance of 5λ (λ: wavelength) or less was studied. The findings are as follows: (1) At a distance longer than λ/10, the current and voltage induced in the detonating fuse are nearly in inverse proportion to the distance. (2) The light emission distance actually measured agrees with the value calculated by the current regression formula. (3) In VHF band, a leakage current detector can be used to determine a guideline for the current induced in the electric detonator. (4) In the range of $R > \lambda/10$ in the 145 MHz band, the induced current flowing through the electric detonator I(A) can be estimated using the following formula: I = 0.015(GP)/ sup/0.5//R, where I is the current (A),G is the absolute gain of the transmitter antenna, P is the radiation power (W), and R is the distance (m). (1 fig, 1 tab)

5113 (IES—8801, pp 129-130) **Method for nondestructive inspection of sodium chlorate candle.** Kurose, Shigeo; Kaneko, Yoichi; Kido, Akira; Kusakabe, Masao. (Midori Anzen Kogyo Co., Ltd., Tokyo, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transactions of annual meetings 1988 of the Industrial Explosives Society, Japan.

A method for 100% nondestructive inspection aimed to improve the reliability of sodium chlorate candle cores was studied. The principle of this method is as follows: An electromagnetic transformer with a C-type core is used. A part of the core is cut, and an object is inserted into this cut to obtain the magnetism as the output voltage of the secondary winding. Using the fabricated measuring instrument, various samples were measured. The results of this measurement have revealed that the degree of dispersion of the ferromagnetic substance mixed in the powder in the core can be easily measured in a short time. It seems that the instrument can be generally used as a powder measuring instrument if its sensitivity is improved. (4 figs)

5114 (IES—8801, pp 131-132) **Effect of pressure on thermal reaction of metal oxides and reducers (Part 1).** Nakamura, Hidetsugu; Oishi, Junzo; Hara, Yasutake. (Kyushu Inst. of Tech., Faculty of Engineering, Kitakyushu, Japan). 11 May 1988. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755327/JAW.

In Transaction of annual meetings 1988 of the Industrial Explosives Society, Japan.

When pyrotechnics are burnt, high pressure is generated. The effect of this high pressure on the thermal reactivity and burning reactivity of oxidizers and reducers was studied. (1) Effect of atmospheric pressure on pyrolysis of oxidizers: With alpha-type lead dioxide, the temperature at which early-stage pyrolysis starts was near 355°C regardless of the pressure. With minium, that temperature depended on the pressure. (2) Effect of pressure on thermal reaction of a mixture of lead dioxide and a reducer: Thermal reaction of boron mixtures was not so much influenced by pressure. For zirconium and molybdenum, the reactivity increased when the pressure dropped. (3) Effect of pressure on thermal reaction of a mixture of minium, lead oxide, and a reducer: Thermal reaction of boron mixtures was not influenced by the atmospheric pressure. For zirconium mixtures, the reactivity was high when the pressure was low. (6 figs, 1 ref)

5115 (SAND—88-2393) **An experimental study of the burn rate of TiH/sub 1.65//$KClO_4$ pyrotechnic under confinement.** Hingoràni-Norenberg, S.L.R. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 62p. NTIS, PC A04/MF A01. Order Number DE89002995/JAW.

Titanium subhydride potassium perchlorate is a pyrotechnic powder used extensively in valve actuators. The linear burn rate behavior of this material is of interest in the design of these actuators. In this study, the variation of the burn rate of TiH/sub 1.65//$KClO_4$ with bulk density in a zero-free-volume closed bomb is investigated. The data collected indicate that the burn rate of TiH/sub 1.65//$KClO_4$ increases with increasing bulk density to a maximum of approximately 700 m/s near 70% of the theoretical maximum density (TMD). Any additional increase in density appears to decrease the burn rate. This variation of burn rate with bulk density and the results of gas permeability measurements are discussed in terms of conductive and convective burning. 44 refs., 18 figs.

5116 (SEGJ—8801, pp 128-133) **Wall, ground and air vibrations caused by explosions inside a structure.** Kobayashi, Naota; Murata, Tamotsu; Kuroda, Eishi. (Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan; Nippon Koki Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Wall, air and ground vibrations caused by explosion inside a structure were studied. Dynamite and slurry explosive were used as explosives. Closed type structure was made of 10cm thick reinforced concrete. The housing cells in which cartridges were dispersed and storaged were constructed. Explosive sounds, ground vibrations and wall accelerations were measured by changing explosive source conditions and structure conditions. The explosive sound is impulse one of short duration. Strongest sound is eruptive gas sound from ventilation duct, and the dominant frequency is desultory. The sound becomes higher with increase of explosive amount. The ground vibration at wall base showed larger amplitude in case of upward cell and sand packaging container and this amplitude decreased remarkably at a 20m distance. The ground vibration at wall base showed lower amplitude in case of lateral cell because the almost all vibrations were caused by sand falling shock. The wall base vibration in case of air shooting was caused by wall vibration. Wall acceleration was 20-70G for the upward cell and exceeded 100G for lateral cell. The correlation between wall acceleration and sound frequency was found for air shooting but not found for explosive in sand. (4 figs, 6 tabs)

5117 (SEGJ—8801, pp 134-137) **Generation and properties of ground vibrations by underwater explosions.** Kuroda, Eishi; Kobayashi, Naota. (Nippon Koki Co., Ltd., Tokyo, Japan; Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Generation and properties of ground vibrations by underwater explosions were investigated. The industrial explosive was exploded at depth of 260 cm in a pond with width of 30 m and length of 130 m, and ground vibration, sound due to the explosions were measured at several positions. The waveforms of ground vibration were affected more markedly by ground structures near the measuring spots and nearby structures than by the distance from an explosion point. Especially concrete water channel had a remarkable influence on the waveform because it was laid along the propagation path of ground vibration. The amplitudes of ground vibration were indicated maximum values at all measurng spots in the horizontal vibration at direction of an explosion point, and were indicated maximum values at the border of the pond and the level ground in the horizontal vibration at right angle direction to an explosion point. As the quantites of the explosives were increased, the amplitude became large except at specified positions. Predominant frequencies were 6.5 to 9 Hz regardless of the quantities of the explosives. The underwater shock wave is not the main generation source for ground vibration. Sound and ground vibration by explosion in comparatively shallow water are generated by inertial motion which is caused by bubble pulsations of the water medium. (6 figs, 2 tabs)

5118 (UCRL—21121) **Initiation thresholds of unusual explosives.** Bloom, G.H.; Adolph, H.G. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003019/JAW.

We have used an electric gun to measure the initiation thresholds of more than twenty unusual explosive materials as well as the thresholds of several common explosives for comparison. The purpose of the work was to obtain experimental data for a theoretical study of the effects of various chemical groups on the detonation sensitivity of explosives. 2 refs., 3 figs., 1 tab.

4502 Nuclear

REFER ALSO TO CITATION(S) 4660

5119 (DOE/NV/10327—37) **Operation Musketeer: Onsite radiological safety report for announced nuclear tests, October 1986--September 1987.** Mullen, O.W.; Eubank, B.F. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Nov 1988. Contract AC08-84NV10327. 150p. NTIS, PC A07/MF A01. Order Number DE89002756/JAW.

Musketeer was the name assigned to the series of underground nuclear experiments conducted at the Nevada Test Site from October 1, 1986 through September 30, 1987. This report includes those experiments publicly announced. Remote radiation measurements were taken during and after each nuclear experiment by a telemetry system. Monitors with portable radiation detection instruments surveyed reentry routes into ground zeros before other planned entries were made. Continuous surveillance was provided while personnel were in radiation areas and appropriate precautions were taken to protect persons from unnecessary exposure to radiation and toxic gases. Protective clothing and equipment were issued as needed. Complete radiological safety and industrial hygiene coverage were provided during drilling and mineback operations. Telemetered and portable radiation detector measurements are listed. Detection instrumentation used is described and specific operational procedures are defined.

5120 (FRCEA-TH—138) **Seismic signal simulation and study of underground nuclear sources by moment inversion.** Crusem, R. (Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France); CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). Sep 1986. 323p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE88756016/JAW.

Some problems of underground nuclear explosions are examined from the seismological point of view. In the first part a model is developed for mean seismic propagation through the lagoon of Mururoa atoll and for calculation of synthetic seismograms (in intermediate fields: 5 to 20 km) by summation of discrete wave numbers. In the second part this ground model is used with a linear inversion method of seismic moments for estimation of elastic source terms equivalent to the nuclear source. Only the isotrope part is investigated solution stability is increased by using spectral smoothing and a minimal phase hypothesis. Some examples of applications are presented: total energy estimation of a nuclear explosion, simulation of mechanical effects induced by an underground explosion.

5121 (UCID—21523) **Determination of the bounding backfill loads for lateral deflection analysis of a downhole canister.** Chen, J.C. (Lawrence Livermore National Lab., CA (USA)). 18 May 1988. Contract W-7405-ENG-48. 77p. NTIS, PC A05/MF A01 - OSTI. Order Number DE89003714/JAW.

The main objective of this study is to develop analytical models that will allow us to predict the effect of the hole geometry, stemming material, canister position, and the canister rigidity on the distortion of the canister structure. Numerous potential sources of loads that cause canister distortion are identified. Three loading scenarios that can potentially produce uneven loads during stemming are identified: an off-center canister, a canted canister, and the canister in an imperfect hole. The canister structure is modeled by an equivalent continuum methodology. A simple procedure is proposed for analysis of backfill-canister interaction. Two steps are most important for the proposed procedure: determination of unbalanced bounding backfill loads and estimation of the lateral resistance of the stemming material. Theories for determination of unbalanced bounding loads on the canister are developed based on extending the classical Janssen's arching theory, which applies only to simple silo loads in the symmetrical case, to the problem of the loading in an eccentric or a nonvertical annular emplacement system. A computer program has been developed for the general procedure of unbalanced bounding loads calculation. The lateral force-deflection characteristics on the buried canister are developed on the basis of laboratory experimental data. Unbalanced pressures and loads are calculated on the Bodie canister for three postulated loading scenarios. The order of magnitude of calculated pressures and loads is reasonable in comparison to the measured data. The variation of lateral loads with depth is significant for nonvertical and washout cases. The effect of the loading scenarios on the magnitude and the profile of calculated lateral loads is important. 41 refs., 22 figs., 4 tabs.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 4693, 5049

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 5131

5122 (DOE/ER/60304—4) **Evaluation of climatic models: Comparison of simulated and observed patterns for past climates: Progress report, February 1, 1988--January 31, 1989.** Prell, W.L.; Webb, T. III; Kutzbach, J.E. (Brown Univ., Providence, RI (USA). Dept. of Geological Sciences). Nov 1988. Contract FG02-85ER60304. 11p. NTIS, PC A03/MF A01. Order Number DE89003023/JAW.

During the past several years, we have used paleoclimatic data to test NCAR CCM (National Center for Atmospheric Research, Community Climate Model) after changing its boundary conditions to those appropriate for simulating past climates. We have assembled regional and global paleoclimatic data sets of pollen, lake level, and marine plankton data, and calibrated many of the data in climatic terms. We have also developed methods that permit direct quantitative comparisons between the data and model results. Our comparisons have shown both some of the strengths and weaknesses of the model. The research so far has shown the feasibility of our methods for comparing paleoclimatic data and model results and has provided valuable tests of the NCAR CCM, Version Zero, which is an atmospheric GCM (AGCM). Our research has also shown that the comparison of the model results with the data is an evolutionary process, because the models, the data, and the methods for comparison are continually being improved. We are therefore conducting a systematic series of tests of a hierarchy of versions of the NCAR CCM, each incorporating more or different degrees of freedom in terms of what they simulate. These versions include models with a full seasonal cycle, soil moisture feedback, a mixed layer ocean with sea ice, and both uncoupled and coupled dynamical oceans. This same hierarchy of models has been and is being used in carbon dioxide experiments by Warren Washington and his colleagues at NCAR, and we plan that the models used in our paleoclimatic experiments will parallel the model developments in their carbon dioxide experiments. 33 refs.

5123 **(NP—9770029) Dynamic interaction of cumulus convection with its large scale environment.** Koenig, W. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). 1987. 60p. (In German). NTIS (US Sales Only), PC A04. Order Number DE89770029/JAW.

Asuming convective clouds as independent plumes in the large-scale mean flow the small scale effects on the vorticity budget can be described by the momentum difference induced by the clouds at the boundary of the large-scale area. B/C-scale observations during GATE Phase III have been selected and arranged in composites according to the maximum cloud coverage of deep convection. Within these composites the large-scale terms of the vorticity budget are determined. During periods of intense convective activities detrainment effects become important in theupper troposphere, while large-scale horizontal advection of vorticity is reduced in the middle layers. The comparison of the different contributions to the budget shows that the twisting effect plays a major role in the generation of vorticity in the cloud ensemble. The eddy effects in the large-scale budgets are mainly influenced by the cloud mass flux and the momentum difference between the cloud ensemble and the large-scale environment. For the determination of the cloud mass flux distribution established parameterization schemes (e.g. Arakawa and Schubert 1974) can be used. The momentum of the cloud ensemble is investigated by deriving two different parameterization concepts.

5124 **(PNL-SA—15073) Applications of digital image processing to ongoing research in complex terrain meteorology.** Hubbe, J.M.; Whiteman, C.D.; Foote, H.P.; McWethy, L.G. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 7p. (CONF-8710161—2). NTIS, PC A02/MF A01. Order Number DE89001749/JAW.

From Digital image processing and visual communications technologies in meteorology conference; Cambridge, MA, USA (26 Oct 1987).

Digital elevation models and Landsat 5 Thematic Mapper (TM) scenes constitute image resolution data over spatial domains of typical interest in complex terrain meteorology. Techniques in use and under development for applying these data to research problems are presented. Topics include decorrelation of topographic shading under direct beam illumination and investigation of nighttime surface temperature. 6 refs., 8 figs.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 4416, 4422, 4681, 4684, 4816, 4817, 4852, 5180, 5230, 5232, 5239

5125 **(ADRP—8711) Emission inventory of sulphur oxides and nitrogen oxides in Alberta. Vol. 4. Results of the emission source surveys.** Picard, D.J.; Colley, D.G.; Boyd, D.H. (Acid Deposition Research Program, Calgary, Alberta (Canada)). Nov 1987. 258p. (MICROLOG—88-00584). Acid Deposition Research Program, 150 Sixth Ave. SW, Suite 3800, Calgary, Alta., Canada T2P 3Y7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Three comprehensive inventories of acid forming emissions in Alberta have been developed: a sulphur dioxide emission inventory, a nitrogen oxides emission inventory, and an inventory of air quality monitoring stations. The inventories are intended to serve as a source of information that will assist investigators in estimating the average rates of NO/sub x/ and SO/sub 2/ emission in Alberta, and the distribution of these emissions by geographic area, industry tupe, and environmental setting. The inventories will also be useful in predicting changes in emission levels. Administrative information is also provided for each industrial source to facilitate source-specific research. This volume presents the results of emission source testing and sampling program conducted as part of the emissions inventory. Six stack surveys were conducted on the incinerator stack for the sulfur recovery unit at a sour gas plant; sulfur oxides were the dominant pollutant emitted, at a maximum rate of 50.534 tonnes/d. In a nitrogen oxides source sampling program, natural gas fueled reciprocating and turbine engines were tested, in order to establish Alberta-specific NO/sub x/ emission factors for these kinds of engines, which are the major industrial sources for such emissions. Incinerator stacks for sulfur recovery units were also tested for NO/sub x/ emissions, and were not found to be significant sources of this pollutant. 2 refs., 104 tabs.

5126 **(CONF-8804214—1) Atmospheric carbon dioxide, climate, and global vegetation change.** Post, W.M. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01. Order Number TI89002196/JAW.

From Global vegetation change: considerations for developing a long-term research plan; Laxenburg, Austria (16 Apr 1988).

Over the past several decades, significant progress has been made in measuring and understanding the global carbon cycle and in developing methods for projecting future changes in the atmospheric CO_2 concentration. During this time, a natural starting point was to check the balance sheet that accounts for all carbon as it exchanged between the major global carbon reservoirs. While it is possible to achieve a balance for a single instant in time, it is not possible with current information to balance carbon fluxes for decade or longer time periods. The inability to account for all carbon exchanges indicated an insufficient knowledge of global carbon cycle processes. In this paper, I outline the scale of the discrepancies involved and offer hypotheses concerning previously underappreciated carbon fluxes that suggest new research directions. These hypotheses postulate global vegetation change at several time scales as a plausible reason for our inability to "balance" the global carbon cycle over long time periods. 47 refs.

5127 **(CORR—860397) Atomspheric contaminant transport analysis and human health risk assessment of Savannah River Plant waste sites: Final report.** Holten, G.A.; Montague, D.F.; Johnson, M.P.; Muhlheim, M.D.; Farmer, S.B.; Mills, C.L.; Strouse, R.D. (JBF Associates, Knoxville, TN (USA)). 20 Mar 1987. Contract AC09-76SR00001. 218p. (JBFA—104-86). NTIS, PC A11. Order Number DE89002421/JAW.

This report, which consists of a main report and 26 appendix reports, documents the contribution to the Environmental Information Document (EID) effort. Specifically, the main report describes, in detail, the methodology (models, data, assumptions, and procedures) of the atmospheric contaminant transport analysis and human health risk assessment of SRP waste sites, and it includes

tables that summarize the assessment data, procedures, and results. Each individual appendix report contains text that documents, in site-specific terms, the methodology used in the analysis of that waste site functional grouping; and a set of comprehensive tables that quantify, for each of the waste sites in the grouping, the atmospheric source terms, air concentrations (for calculating worker exposures), air-related pathway exposures, and risks associated with the cleanup options for the waste site(s). Each appendix report is a "stand-alone" document formatted to facilitate SRL's direct incorporation of the information in the EIDs. 50 refs., 16 figs., 44 tabs.

5128 **(DOE/ER—0385) Carbon dioxide and climate: Summaries of research in FY 1988.** (USDOE Office of Energy Research, Washington, DC. Carbon Dioxide Research Div.). Oct 1988. 93p. NTIS, PC A05/MF A01. Order Number DE89002966/JAW.

Detailed worldwide measurements indicate that the amount of carbon dioxide in the earth's atmosphere has increased about 25 percent during the past 188 years, primarily because of fossil-fuel combustion and deforestation. Carbon dioxide is one of several trace gases that can modify the earth's heat balance by absorbing outgoing radiation from the earth's surface, thereby increasing the amount of heat retained by the atmosphere--the so-called greenhouse effect. Scientific analyses suggest that this increase could substantially affect climate, agriculture, and other human endeavors. The Carbon Dioxide Research Program is aimed at improving the scientific knowledge base to enable researchers to project future atmospheric concentrations of carbon dioxide, to estimate carbon dioxide-induced global and regional climate changes, and to assess the responses of vegetation to higher concentrations of carbon dioxide and changing climate. The Department of Energy is the lead federal agency for research related to atmospheric carbon dioxide. Its responsibility is to sponsor a program of directed research and to coordinate this research with relevant activities of other federal agencies, private concerns, and international institutions. This Program Summary documents the activities and products of the Carbon Dioxide Research (CDR) Program in Fiscal Year 1988. The Summary provides descriptions of all projects funded during the year and a brief overview of the CDR Program's goals, objectives, and organization. 1 fig., 3 tabs.

5129 **(DOE/ER/60293—3) [Chemistry of atmospheric precipitation at Lewes, Delaware, as part of the multi-state]: Progress report.** Scudlark, J.R.; Church, T.M. (Delaware Univ., Lewes (USA). Coll. of Marine Studies). 23 Sep 1988. Contract FG02-85ER60293. 15p. NTIS, PC A03/MF A01. Order Number DE89003373/JAW.

From August 1978, through August 1988, a total of 697 precipitation events were recorded at Lewes (averaging 5.9 events per month). Due to low volume events, samples rejected due to contamination, and events missed due to power failure/equipment malfunction, 14% of these events were not analyzed for all major ions. However, expressed in terms of volume, only 1.3% of the total incident precipitation at Lewes was not analyzed during this period. In addition to precipitation events, 52 field blanks have been conducted since the inception of this testing protocol in 1983. These blanks correspond to antecedant dry periods of 7 days (168 hours), and are part of the network QA/QC Program. Additionally, "blind" QA samples are processed and shipped on a quarterly basis. Qualitatively, trends in precipitation composition at Lewes are consistent with other inland MAP3S sites: observed summer maxima in acidity reflect seasonal peaks in the two predominant acid components, nitrate and sulfate. Quantitatively, the concentrations of protons, excess sulfate and nitrate measured at Lewes are somewhat less than the MAP3S average, perhaps reflecting the influence of relatively "clean" ocean air masses at the coast. 21 refs., 5 figs., 2 tabs.

5130 **(ENEA-RT/STUDI—87-6) A computerized emission data acquisition system: preliminary results on air pollutants generated in Italy by combustion processes.** Bocola, W.; Cirillo, M.C.; Trozzi, C. (ENEA, Rome (Italy)). Apr 1988. 17p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755364/JAW.

The article describes the computerized data acquisition system, (still under development), used to estimate the emissions, due to combustion processes, of the five main air pollutants: sulphur oxides, nitrogen oxides, total suspended particles, carbon monoxide and volatile organic compounds. A first estimate, intended to provide some indication of the emission time trend, covers the years 1976, 1980 and 1984. Here, emissions were divided with regard to both large fuel consuming sectors (industrial, power plant, residential and commercial, agricultural and transportation), and the type of fuel used (coal, lignite, natural gas, oil products, ecc.). A further estimate was made, with reference to 1980, with emissions being broken down both in regard to individual Italian regions and to the large sectors. The overall 1980 estimates, referring to the country as a whole, were then compared with those of the main OECD countries.

5131 **(GSF-BPT—8/88) HCl/Cl/sup -/ distribution in European areas. Final report.** Baechmann, K. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 8 - Anorganische Chemie und Kernchemie; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1988. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755396/JAW.

In this project, new analytical methods for the investigation of the chlorine cycle were developed, and field measurements in European areas were carried out. Cl/sup -/, NO/sub 3//sup -/, SO/sub 4//sup 2-/, NH/sub 4//sup +/, Na/sup +/, HCl, and NH/sub 3/ as well as chlorinated hydrocarbons and their degradation products were determinated. Average values, vertical distributions, and average mol m/sup -2/ calculations over the Atlantic Ocean, the Mediterranian and West Germany were estimated and interpreted with results of ground measurements. These measurements allow for the first time a comparison of chloride released from sea salt aerosols and gaseous HCl. Additionally, an ionchromatographic method was developed to analyse chloroacetate and dichloroacetate, and field measurements were carried out with rainwater samples. Concentrations between 0,3 and 4,4 ng/ml were found. (orig.) With 42 refs., 7 tabs., 33 figs.

5132 **(IFUSP-P—576) The airborne inhalable particles of Sao Paulo.** Orsini, C.; Andrade, F.; Artaxo, P. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1986. 3p. (CONF-860803—6). NTIS (US Sales Only), PC A02. Order Number DE89002986/JAW.

From 7. world clean air congress and exhibition; Sydney, Australia (25 Aug 1986).

The behavior of trace constituents of fine ($<2.5\mu m$) and coarse ($2.5--15\mu m$) particles have been investigated in order to obtain a better understanding of some characteristics of time variation concentrations of inhalable particles of the atmospheric aerosol of Sao Paulo, in the period 1983-1985. Coarse and fine particles have been weekly sampled by stacked filter (nuclepore) unit samplers. Collected samples have been analyzed gravimetrically, for fine and course particle concentrations, and by PIXE (particle induced x-ray emission), for trace element concentrations. It was found that, while the averaged concentrations of the fine particles remain practically constant during the whole year, concentrations of the coarse particles increase by Factor 2 comparing summer to winter. No correlation ({bar r} $\cong$ 0.06) between these two components of the inhalable particles was found in winter but some correlation ({bar r} $\cong$ 0.06) was found in summer. Generally speaking, these and other characteristics might be explained by mechanisms of meteorological nature (basically the heavy rains in summer and the frequent radiation thermal inversions in winter). 4 refs., 2 figs., 1 tab.

5133 **(Juel-Spez—439) Search for indicatory criteria to predict effects of chemical induced stress on ecosystemal level. Vol. 9. Final reports of sponsored projects. Pt. 1.** Scheele, B.; Verfondern, M. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). Apr 1988. 914p. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88755398/JAW.

This is the first part of a series of reports on results of a research program titled 'Search for indicatory criteria to predict effects of chemical induced stress on ecosystemal level'. These studies have been supported since 1980/81 by the German Ministry of Re-

search and Technology. They deal with structural and in some cases as well with functional reactions of terrestrials ecosystems on chemical stress. On the basis of this knowledge, indicatory criteria for the ecosystem itself as well as chemical damage are developed and their efficiency is discussed.

5134 (KFK-PEF—35-Vol.2, pp 383-398) **Anthropogenic dusts in ambient air of Baden-Wuerttemberg: Physico-chemical analysis and toxicologic assessment.** Marfels, H.; Spurny, K.R.; Otto, F.; Fritsche, U.; Iburg, J.; Angerer, G.; Boehm, E.; Koenig, J.; Balfanz, E. (Fraunhofer-Institut fuer Umweltchemie und Oekotoxikologie, Schmallenberg (Germany, F.R.); Fraunhofer-Institut fuer Systemtechnik und Innovationsforschung (ISI), Karlsruhe (Germany, F.R.); Gesellschaft fuer Arbeitsplatz- und Umweltanalytik, Muenster-Roxel (Germany, F.R.)). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

All seven sampling sites were built up, equiped and brought in operation during 1987. More than 50 mineral fiber samples were evaluated by electron microscopy and more than 1000 results were obtained by chemical organic analysis of about 100 filter samples till now. This analysis concerns 17 polycyclic aromatic hydrocarbons (PAH), 6 polychloric biphenyles (PCB) as well as 6 nonvolatile chloro-phenoles (CP). Conductivities, pH-values, as well as ions of NH/sub 4//sup +/, SO/sub 4//sup 2-/, NO/sub 3//sup -/ and metals of Pb, Cd etc. were evaluated in the inorganic analytical program. To evaluate the toxic effects of sampled aerosols, mutagenity, cytotoxicity and phagocytosis tests were applied. First results obtained on extraction fluids showed good dosis-effect correlations. The results show substantial differences in correlation to the emission sources (urban and rural sites), to the meteorological situations and to different seasons of the year.

5135 (KFK-PEF—35-Vol.2, pp 503-511) **Investigation and assessment of personal exposure to indoor and outdoor gaseous and particulate air pollutants.** Schultz, E.; Staiger, H.; Jendritzky, G. (Deutscher Wetterdienst, Freiburg im Breisgau (Germany, F.R.). Zentrale Medizin-Meteorologische Forschungsstelle). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

In this study passive sampling methods are used for integrated personal exposure measurement of gaseous and particulate pollutants. The sampling of nitrogen dioxide and sulphur dioxide is performed by PALMES diffusion tubes. The adsorbed gases are analysed ionchromatographically. For particle deposition measurement transparent collection plated are used. The dust samples are investigated by optical microscopy. Image analysis yields particle size distributions for inorganic and biogenic constituents and combustion products down to a lower detection limit of 3 microns. A preliminary evaluation was based on a two month data set collected in Freiburg between November 13, 1987 and January 15, 1988. The spatial mean of outdoor NO/sub 2/-concentration has a value of 50.2 μg/m/sup 3/, the mean indoor value from 15 homes showed a concentration of 42.4 μg/m/sup 3/. Outdoor particle deposition below 10 micron particle diameter varies significantly with atmospheric diffusion conditions. The spatial distribution of air pollutants reflects not only the emission situation but also microclimatological conditions.

5136 (KFK-PEF—35-Vol.2, pp 523-535) **Analysis of the dispersion of air pollutants over Baden-Wuerttemberg using observation of the TULLA-experiments.** Fiedler, F.; Adrian, G.; Hugelmann, C.P.; Scheu-Hachtel, H.; Walk, O. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Experimental investigations of atmospheric diffusion serve: a) the analysis of mixing and deposition processes for different pollutant matter in the atmosphere and b) the validation of model simulations. Measurements of SO/sub 2/, NO/sub x/ and O/sub 3/ made during the TULLA-experiment over Baden-Wuerttemberg are used to give an overview of their horizontal and vertical distributions. With the aid of the mesoscale atmospheric model KAMM and the diffusion model DRAIS some typical distribution patterns of SO/sub 2/ and their deposition are shown.

5137 (KFK-PEF—35-Vol.2, pp 537-552) **Emission inventories for air-pollutants with a high temporal and spatial resolution for the state of Baden-Wuerttemberg.** Mueller, T.; Boysen, B.; Friedrich, R.; Obermeier, A.; Voss, A. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Based on the emission inventory IKE has elaborated for the State of Baden-Wuerttemberg during the TULLA-measuring-period, IKE is working on a model which will be able to calculate hourly emissions for future time periods and for given boundary conditions. In this interim report mainly the aspects of modelling spatial and temporal allocation of emissions from power plants and the transportation sector will be discussed. Another project IKE was concerned with is a pilot study which develops methods to evaluate an emission inventory for volatile organic compounds (VOC) in a high temporal and spatial resolution. Some results of this study will be presented briefly in this paper by illustrating methods for some cases.

5138 (KFK-PEF—35-Vol.2, pp 553-562) **Chemical reactions of air pollutants during the TULLA campaign.** Beltz, N.; Jaeschke, W. (Umwelt-Data G.m.b.H., Koenigstein/Taunus (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Zentrum fuer Umweltforschung). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Based on the TULLA-measurements of March 25, 1985 mass balances for SO/sub 2/ and sulfate are determined. This was done in order to quantify the mass fluxes due to chemical conversion processes. The comparison between SO/sub 2/-depletion and the formation of sulfate did not show an agreement in fact of stoichiometry. Nevertheless, the calculated conversion rates of 0.17 to 1.35%/h are in a good agreement to literature data which are derived from the reaction of SO/sub 2/ with OH-radicals.

5139 (KFK-PEF—35-Vol.2, pp 563-573) **TULLA-experiment results of XFA- and LMMS-measurements on air particulate matter.** Wieser, P.; Schreiber, H.; Greiner, W. (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Physik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

In order to characterize the main constituents of the air particulate materials sampled at the ground based stations during the TULLA campaign (spring 1985) XFA of particle collectives and laser microprobe mass spectrometry (LMMS) of single particles (size range about 0.1 μm to about 5 μm) is used. An additional episode was carried out in the industrial region Mannheim-Waldhof (Nov. 30, 1987). Eight types of air particulate materials significantly different in the amounts of chloride, nitrate, silicate and sulfate compounds result from cluster analysis of mass spectra of negative ions. In agreement with published aerosol models of negative ions.

In agreement with published aerosol models carbonaceous particles appear as insoluble cores of sulfate, chloride and nitrate containing particles. A deficit in particle borne ammonium and nitrate species is observed in the small particle mode confirming heterogeneous processes as gas to particle conversion mechanisms. Post-ionization of the laser plume by non-resonant two-photon absorption processes shall improve the LMMS technique.

5140 (KFK-PEF—35-Vol.2, pp 575-586) **Application of the DRAIS model in the evaluation of the TULLA experiment.** Nester, K.; Baer, N.; Fiedler, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung; Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The model DRAIS was developed to simulate the pollution distribution and the deposition in a mesoscale area. The model equations and the transformation into a terrain following coordinate system are described. For the TULLA episode from March 21, 1985 a stationary dispersion calculation over Baden-Wuerttemberg for SO/sub 2/ was carried out using the emissions inside of the area and the SO/sub 2/ flux into the area. The calculated concentration field of SO/sub 2/ shows a decrease from northwest to southeast. High concentrations were calculated in the environment of the cities of Heilbronn, Stuttgart and Karlsruhe. The measured and simulated SO/sub 2/ concentrations along the flight route of the aircrafts agree only along the flight route across of Baden-Wuerttemberg. Especially along the northern part of the Upper Rhine Valley the calculations underestimate the observed SO/sub 2/ concentrations.

5141 (KFK-PEF—35-Vol.2, pp 587-600) **Concentration and deposition of sulfur compounds in the FRG resulting from sulfur emissions in Europe.** Halbritter, G.; Braeutigam, K.R.; Kupsch, C.; Sardemann, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Within the framework of this project, which was concluded in 1987, a survey is given of the emission and, as far as possible, also of the concentration and deposition for the air pollutants sulphur dioxide and nitrogen oxides. For the pollutant sulphur calculations of long range transport were made and the impacts of a number of emission reduction strategies were investigated. Estimates of the development of sulphur dioxide effluents for the Federal Republic of Germany (FRG) yield considerable reductions untill the middle of the next decennium. Some European states will achieve comparable reductions of their effluents, other have not planned such measures so far. The analyses demonstrate the high share foreign emissions have in the concentration and deposition of pollutants within the FRG. The planned national emission reduction measures will improve the the environmental situation but not to the extent as could have been expected from the effluent reduction. In the relatively highly exposed area in the middle of the FRG the sulphur deposition will diminish considerably only after international reduction measures have been established.

5142 (KFK-PEF—35-Vol.2, pp 601-613) **Identification of products of the chemical conversion of some selected terpenes and olefines with anthropogenic airborne pollutants (NO/sub x//O/sub 3//SO/sub 2/).** Jay, K.; Stieglitz, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The main products of the addition of N/sub 2/O/sub 5/ to 1-hexene in air are 1,2-hexandiol-dinitrate and 2-hexanon-1-ol-nitrate besides some α-hydroxy-1-ol-nitrate. With cyclohexene, cis/trans-1,2-cyclohexandiol-dinitrate and cyclohexan-1-on-2-ol-nitrate were detected. The reaction of N/sub 2/O/sub 5/ with camphene in air leads to nitrocamphene and other nitrocompounds. On addition of NO/sub 2/ to α-pinene, βpinene and camphene in air, 2-nitrolimonene, 7-nitrolimonene and nitrocamphene respectively are formed. Gasphase ozonolysis of camphene leads to a 1:1 mixture of camphenilone and 6,6-dimethyl-ecaprolacton-2,5-methylene. In the presence of SO/sub 2/ (4 mg/10 l) the product ratio raises to 8:1. From this one can conclude that the Criegee-biradical oxidises SO/sub 2/ to SO/sub 3/ before the cyclisation to the dioxirane. On field measurements the ozonolysis products of α- and βpinene, pinonic aldehyde and nopinone could be detected in the forest air.

5143 (KFK-PEF—35-Vol.2, pp 627-640) **Influence of orography on the deposition of pollutants by fine particles.** Ruck, B.; Adams, E.W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Inst. fuer Hydromechanik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Turbulent diffusion and convection are responsible for the transport of fine particles to individual trees within forests. Combining laser-Doppler anemometry for the measurement of air velocity and turbulence with chemical deposition measurements made on model forests in a wind tunnel, a correlation between large levels of turbulence and deposition has been shown to exist. The present study examines the mutual influence of forest stands and orography on each other and explains the increased level of deposition found in hillside regions in terms of the increased turbulence levels found there. The presence of forests on hills and their stand density are seen to bring about strong changes in the turbulence levels produced over hills, and thus can strongly affect the deposition levels not only locally but at some considerable distance.

5144 (KFK-PEF—35-Vol.2, pp 641-650) **Semi-continuous measurement of sulfuric acid and total sulfate in clean air regions and smog chambers.** Israel, G.W.; Boehm, R. (Technische Univ. Berlin (Germany, F.R.). Fachgebiet Luftreinhaltung). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

A newly developed instrument was used for semi-continuous monitoring of sulfuric acid and total sulfates in a clean air region and a smog chamber. The smog chamber tests showed that in addition to the SO/sub 2/-concentration and the ratio of NO/sub 2/ to hydrocarbons, the relative humidity may play the most important role in producing sulfuric acid or its salts by irradiation. At Edelmannshof a two week period of monitoring showed values up to 0.32 μg/m/sup 3/ of sulfuric acid and 22.0 μg/m/sup 3/ of sulfate.

5145 **(KFK-PEF—42) Analysis of dispersion and deposition of phytotoxic and acidifying air pollutants. Short version.** Braeutigam, K.R.; Halbritter, G.; Brandl, V.; Findling, B.; Fuerniss, B.; Kupsch, C.; Sardemann, G.; Schuler, A.; Schulz, V.; Wiesmann, F.J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse). Aug 1988. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755400/JAW.

First, a survey is given of the emission situation for sulphur dioxide and nitrogen oxides. For the Federal Republic of Germany and selected areas of Europe the regional distribution of emissions is established for the year 1982 and its future development is estimated. The analysis of the pollutant concentration and deposition

for sulphur dioxide in the Federal Republic of Germany confirm the high contribution of foreign emissions. The planned national emission reduction measures will considerably lessen ground level concentration, but not to the extent expected. The fact that for nitrogen oxides such a clear reduction of emissions can not be expected is due to the high releases from transport which must be expected also for the future. This sector is not only the main emittor of nitrogen oxides, but also of hydrocarbons. A number of model calculations for selected central European conditions demonstrates the special relevance of these two compounds which are key substances for the formation of anthropogenic ozone. (orig.) With 25 figs., 20 refs.

5146 **(NP—9770018) Testing of the immission measuring systems for persistent organic substances. Final report.** Guse, W.; Zapff, W. (Rheinisch-Westfaelischer Technischer Ueberwachungs-Verein e.V., Essen (Germany, F.R.); Umweltbundesamt, Berlin (Germany, F.R.)). Mar 1987. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE89770018/JAW.

The known immission measuring systems were to be checked for their suitability for determining persistent organic substances, and modified if necessary. First, the complete system was tested on a gas mixing in the laboratory, and then the suitable systems were used in practice. The detection limits of the methods of analysis are in the group of halogenated alkanes between 15 ng and 300 ng, in the chlorinated benzenes 15 ng, in the other chlorinated organic substances between 0.001 ng and 0.01 ng as well as benzene 0.017 ng. The relative detection limits (1/2 h suction) are: halogenated alkanes: 0.5 to 10 μg/m/sup 3/, chlorinated benzenes: 0.5 μg/m/sup 3/, other chlorinated organic substances: 0.01 to 0.1 μg/m/sup 3/, benzene: 0.2 μg/m/sup 3/. The following concentrations were found by the measurements of outer air: halogenated alkanes: 0.5 to 90 μg/m/sup 3/, chlorinated benzene: 0.5 to 20 μg/m/sup 3/, other chlorinated organic substances: 0.01 to 0.1 μg/m/sup 3/. The uncertainty ranges (standard deviation x Student factor) at a reliability P=95% are within ranges which are usual for trace analysis and thus can be considered to be completely satisfactory. (orig.) With 26 refs., 65 tabs., 28 figs.

5147 **(PB—88-245642/XAB) Review of the Office of Policy, Planning and Evaluation's material-damage assessment: report of the Clean Air Scientific Advisory Committee (CASAC). Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 30 Jun 1987. 28p. (SAB/CASAC—87-033). NTIS, PC A03/MF A01.

The Material Damage Review Subcommittee of the EPA Clean Air Scientific Advisory Committee identified in a report of the impact of acid deposition on building materials, omissions, errors, and biases inherent in the work, and attempts to account for a range of possible alternatives by furnishing lower and upper damage estimates. In view of the uncertainties involved, especially in paint-damage costs, the Subcommittee believes that the total costs from acid deposition should not be used in the Sulfur Oxides National Ambient Air Quality Standards (NAAQS) rulemaking process. Nevertheless, the conceptual framework and procedures that are used in the report do provide useful information that should be considered.

5148 **(PNL-SA—15850) The effect of an isentropic filter on model-reduced trajectories in complex terrain.** Davis, W.E.; Schwartz, M.N. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1988. Contract AC06-76RL01830. 9p. (CONF-880913—6). NTIS, PC A02/MF A01. Order Number DE89001728/JAW.

From ANS topical meeting on emergency response: planning, technologies and implementations; Charleston, SC, USA (26 Sep 1988).

This paper briefly describes the terrain of the Hanford Site and the telemetry stations. Spatial and temporal analyses of potential temperatures based on the telemetry stations are presented with regard to the terrain. Recommendations for filtering the wind fields to account for the complex flow are described, and differences in MESOI transport using original and filtered wind fields are shown. The preliminary results are then summarized and recommendations for future work are made. 2 refs., 4 figs.

5149 **Particle impactor assembly for size selective high volume air sampler.** Langer, G. (to Dept. of Energy, Washington, DC). US Patent 4,764,186. 16 Aug 1988. Filed date 23 Mar 1987. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A particle impactor assembly is described for use in a high volume air sampler apparatus for collecting and separating by size, entrained particles from sampled air, comprising: an inlet element formed to have a horizontal and substantially flat upper portion with a plurality of similar elongate parallel through impactor slots, each having a length V and a width U.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 4565, 5163, 5165, 5167

5150 **(CEA-CONF—9475) Experimental determination of tritium oxidation speed in atmosphere.** Clerc, H.; Calando, J.P.; Paillard, P.; Gros, R.; Hircq, B. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)). 1988. 4p. (In French). (CONF-880404—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755332/JAW.

From 7. international congress of the International Radiation Protection Association; Sydney, Australia (10 Apr 1988).

In the framework of fusion reactor safety studies it is necessary to know the kinetics of gaseous tritium oxidation. Literature differences have conducted the European Communities to realize a research program in case of tritium release for a rapid accidental release and for a slow routine release. This report gives the experimental conditions and the results of rapid accidental release. Experiments have been done at Bruyeres-le-Chatel (FR) with a 40 meters chimney.

5151 **(NRPB-R—220) Environmental radioactivity surveillance programme: results for the UK for 1985 and 1986.** Smith, D.M.; McAllister, G.; Gemmill, J.; Welham, D.; MacLennan, S. (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 40p. H.M. Stationery Office, London, price Pound 5.00.

This report is the sixth of a series in which the results of the Board's environmental radioactivity surveillance programme are presented. Samples of airborne dust, rainwater and milk are collected routinely throughout the UK and in the Channel Islands. Milk is also sampled in the Isle of Man. The concentrations of various radionuclides are measured and the resulting exposure of the population is evaluated. The radionuclides detected during 1985 and the early part of 1986 result predominantly from nuclear weapons testing in the atmosphere, and in this period the average concentrations and depositions were at the lowest levels since the inception of the Board's monitoring programme. Following this period and for the remainder of 1986 the activity concentrations in airborne dust, rainwater and milk increased as a direct result of the nuclear reactor accident at Chernobyl.

5152 **(SCPRI-RM—4-1988) Monthly results of measurements, Apr 1988.** Anon. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Apr 1988. 45p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755340/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water, drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

5153 **(SCPRI-RM—5-1988) Monthly results of measurements, May 1988.** Anon. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). May 1988. 47p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755341/JAW.

This report of the SCPRI exposes an interpretation of the principal results concerning the routine monitoring of environmental radioactivity in France: atmospheric dusts, rainwater, surface water, underground water, sewage water drinking water, food chain (milk, vegetables, fishes), sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables. This report exposes also the results of special radiation measurements resulting from the Chernobyl accident.

5006 Regulations

REFER ALSO TO CITATION(S) 4675, 4682

5154 **(NP—9770009) Automobile exhaust gas scenarios in the Federal Republic of Germany - a study considering the resolutions passed by the EEC Environmental Ministers Conference.** Brosthaus, J.; Hassel, D.; Jost, P.; Sonnborn, K.S.; Waldeyer, H. (Technischer Ueberwachungs-Verien Rheinland e.V., Koeln (Germany, F.R.). Inst. fuer Energietechnik und Umweltschutz; Umweltbundesamt, Berlin (Germany, F.R.)). Oct 1985. 32p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770009/JAW.

The study analyzes and discusses the effects of the resolution passed by the EEC Environmental Council in June 1985 on 'measures to be taken against air pollution caused by automobile exhaust gases' on the development of commercial vehicle and passenger car exhaust gas emissions in the Federal Republic of Germany. Calculations are based on a prognostic model developed by TUEV Rheinland on behalf of the Commission of the European Communities. The model was modified to suit the study's particular purpose. The forecasting results obtained show the reduction of emissions to be largely owing to the prompt implementation of low-pollution and quasi-low-pollution engine designs. In spite of the larger fleets and higher total kilometric performances expected for the future, manufacturers' statements on market potentials and on the efficiency of low-pollution designs allow to assume nitrogen oxide reductions of about 57%, hydrocarbon reductions of about 65%, and carbon monoxide reductions of about 73% from 1985 through the mid nineties.

5155 **(VW-FMT—8705V/5) Comment concerning proposed changes to the Clean Air Act.** Kuhler, M. (comp.). (Volkswagenwerk A.G., Wolfsburg (Germany, F.R.). Abt. Forschung und Entwicklung). 30 Sep 1987. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755156/JAW.

Concern on the effects of acid rain and non-attainment of the ozone standard in numerous areas triggered activities in the US Congress to change the Clean Air Act. The intended changes concerning light duty vehicles not only propose tighter nominal standards, but also an extended 'useful life' of 100,000 mi and an AQL of 10% for Selective Enforcement Auditing (S.E.A.). Both additional requirements result in more stringent 'effective emission standards' as compared to the nominal standards. Especially changing the AQL from now 40% to 10% would make S.E.A. more stringent in relation to certification. In this way vehicles could be certified, which would be unable to pass S.E.A. when in mass production.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 4832, 4833, 4834, 5174

5156 **(LA-UR—88-2376) The effects of spatially-varying soil properties on soil erosion.** Springer, E.P.; Cundy, T.W. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 30p. (CONF-881222—1). NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88014335/JAW.

From ASAE international symposium on modeling agricultural, forest, and rangeland hydrology; Chicago, IL, USA (12 Dec 1988).

The objective of this study is to investigate the effects of only rainfall excess generation on erosion. We illustrate the effects of spatial variation in saturated hydraulic conductivity (K/sub s/) on the spatial and temporal distributions of erosion resulting from overland flow. We use this as a basis to demonstrate the potential for bias in parameters estimated from field data. Mathematical modeling of soil erosion must include surface runoff the dominant transport mechanism. Rainfall excess when routed over the surface, produces a distribution of velocities and depths in response to surface, roughness, surface form or microtopography, and available water. The spatial distribution of velocities and depths strongly affects sediment delivery as well as the re-distribution of soil on the hillslope. 23 refs., 12 figs., 3 tabs.

5157 **(ORNL/M—659) Investigations of relationships between oil field materials and practices and wildlife: Progress report, May 1988--October 1988.** Suter, G.W. II; Gustin, M.K.; Floit, S.B.; Barnthouse, L.W.; Shugart, L.R.; Jimenez, B.D.; McCarthy, J.F. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01. Order Number DE89002676/JAW.

Much of this period was devoted to obtaining the necessary equipment at Elk Hills, working out sampling and sample transfer procedures, and determining the suitability of existing samples for the available analytical procedures. Results are not yet available for some of the samples obtained during this period and the number of samples of all types is small. Therefore, the results presented here do not support extensive analysis or interpretation. A demographic analysis of the San Joaquin kit fox is also being conducted. Results of an analysis of data previously published are presented in this report. 22 refs., 2 figs., 10 tables

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 4121, 4820, 4822, 5168

5158 **(CONF-881209—1) Comparison of an unsaturated soil zone model (SESOIL) predictions with a laboratory leaching experiment.** Hetrick, D.M.; Travis, C.C.; Kinerson, R.S. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 18p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88009058/JAW.

From Winter simulation conference; San Diego, CA, USA (12 Dec 1988).

Model predictions of a modified version of the soil compartment model SESOIL are compared with laboratory measurements of pollutant transport in soil. A brief description of SESOIL is given and modifications that have been made to the model are summarized. Comparisons are performed using data from a laboratory soil column study involving six chemicals (dicamba, 2,4-dichlorophenoxyacetic acid, atrazine, diazinon, pentachlorophenol, and lindane). Overall, SESOIL model predictions are in good agreement with the empirical data. Limitation of the model are discussed. 15 refs., 2 figs., 3 tabs.

5159 **(Juel-Spez—441) Methods for the ecotoxicological evaluation of chemicals. Vol. 11. Terrestrial systems II. Report: 1979-1986.** Verfondern, M.; Scheele, B. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projektleitung Biologie, Oekologie, Energie). Apr 1988. 166p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755154/JAW.

This report presents research works which were conducted within the scope of the project entitled 'Methods for the Ecotoxicological Evaluation of Chemicals' sponsored by the Federal Ministry for Research and Technology (BMFT). The herein comprised eight papers deal with terrestrial ecosystems - each from a different point of view, however. Two papers evaluate environmental chemicals with respect to their effects on microorganisms in soil. Subject of three works is the uptake of pollutants by plants out of the air as well as from different cultural soils. Non effect values are recommended and test plants are suggested. Additional two projects examine cell wall components which are able to bind environmental chemicals, thus influencing their inherent ecotoxicological risk. The last paper deals with the general chemical characteristics of environmental chemicals aiming to predict the decomposition behaviour of these substances.

5160 **(NP—9770022) Assessment and modelling of chemical fluxes in soil.** Fraenzle, O.; Bruhm, I.; Gruenberg, K.U.; Jensen-Huss, K.; Kuhnt, D.; Kuhnt, G.; Mich, K.; Mueller, F.; Reiche, E.W. (Kiel Univ. (Germany, F.R.). Geographisches Inst.; Umweltbundesamt, Berlin (Germany, F.R.)). 30 Nov 1987. 440p. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89770022/JAW.

On the basis of graphtheoretic models of chemical fluxes through the environmental compartments lower atmosphere, vegetation, soil and water the present investigation is focused on the experimental assessment and modelling of transport and transformation processes of chemicals in soil. To this end representative test soils and sites were selected by means of geostatistical methods, and test substances on the basis of comparable multivariate classification algorithms. The comprehensive experiments involve test approaches on four complementary levels of complexity and provide for data sets which permit the formulation and validation of a generalized simulation model of chemical fluxes in soil. It links the results of various test levels and thus permits a much better interpretation of sorption isotherms in terms of 'real-world' situations. (orig.) With 351 refs., 48 tabs., 86 figs.

5161 **(PNL-SA—16048) Determination of sorbed metals, amorphic Fe, oxidic Mn, and reactive particulate organic carbon in sediments and soils.** Jenne, E.A.; Crecelius, E.A. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 7p. (CONF-8809171—1). NTIS, PC A02/MF A01. Order Number DE89001744/JAW.

From 3. international conference on environmental contamination; Venice, Italy (28 Sep 1988).

A current approach to evaluating the potential toxicity of metal pollutants (MP) in sediments requires using methods for estimating sorbed metals, amorphic Fe oxide, Mn oxides, and reactive particulate organic carbon (RPOC). Methods for estimating these variables are reevaluated and extraction conditions optimized. The hydroxylamine hydrochloride method, used to estimate the quantities of sorbed metals and amorphic Fe oxide and oxidic Mn adsorbents, was found to yield excellent recovery of MP spikes added at the beginning of the extraction, and adequate precision and selectivity for amorphic over crystalline Fe oxides. Hot KOH was tentatively selected over NH_4OH for estimating RPOC because of its greater convenience; correlations with laboratory sorption experiments will be required to provide an adequate basis for selection. Determination of both sorbed metals and RPOC are relatively insensitive to solid-to-extractant ratio. Metal pollutants and RPOC extraction are also relatively insensitive to normality of HCl and KOH, respectively. 10 refs., 2 figs.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 4205, 4226, 4227, 4764, 5152, 5153

5162 **(INIS-mf—11328, pp 57) Depth distribution and migration of radionuclides in soils.** Meisel, S.; Graller, P.; Kahr, G.; Mueller, H.; Ninaus, W. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik; Verein zur Foerderung der Anwendung der Kernenergie, Graz (Austria). Reaktorinstitut). 1988. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5163 (INIS-mf—11328, pp 59) **Internal radiological burden of human muscle tissue from radioactive cesium.** Rabitsch, H.; Feenstra, O.; Kahr, G. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik; Graz Univ., Institut fuer Gerichtliche Medizin, Universitaetsplatz 4, Graz (Austria); Verein zur Foerderung der Anwendung der Kernenergie, Graz (Austria). Reaktorinstitut). 1988. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5164 **(INIS-mf—11839) Chernobyl reactor accident and its effects on the Bremen area. Radioactivity measurements from May through September 1986 and dose assessment.** Fischer, H.; Moser, D.; Urbach, M. (Bremen Univ. (Germany, F.R.)). Oct 1986. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755579/JAW.

Universitaet Bremen, Information zu Energie und Umwelt. Teil A.; no. 24.

Chapter 2 of the report gives an outline of the design of the RBMK-1000 reactor and its inventory of radionuclides at the time the accident happened, together with a brief scenario of possible events leading to the accident, and an assessment of total radionuclide release. Chapter 3 explains the measurement campaigns made in the Bremen area in the given period and the consequences to be drawn from measured data up to present time. The measuring campaigns are described by a full-test report, graphical illustration, and a table of measured data. The information covers all data collected from onset of radioactivity release up to the 9th of Sept. 1986. Chapter 4 describes the assessment of dose commitment by the Bremen population, on the basis of measured radionuclide concentrations in the environment. Chapter 5 discusses the possible health hazard to the population in accordance with current knowledge of radiation exposure and its effects. Chapter 6 summarizes and interprets the results, and chapter 8 presents definitions of concepts and terminology.

5165 **(OEVS-Mitteilung—1/1988) Radioecology, emissions and immissions. Spring meeting 1984. Proceedings of the 9. annual meeting of OESRAD.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna) (ed.). (Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna). 1988. 86p. (In German). (CONF-8406372—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW.

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

7 contributions are presented on radionuclide emissions from particular nuclear installations, on radionuclide migration and measurements in the environment, on the equipment of a particular laboratory and on setting limiting values. All of them are in INIS scope and are treated separately. (qui).

5166 (OEVS-Mitteilung—1/1988, pp 65-70) **New low-level laboratory of the Arsenal Federal Experimental Plant.** Rank, D. (Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

At the Arsenal Federal Experimental Plant a new laboratory for measuring low level radioactivity concentrations has been installed. Measures taken to reduce the background as well as the equipment and the goals of the laboratory are shortly described. 1 tab. (qui).

5167 (OEVS-Mitteilung—1/1988, pp 71-86) **Geophysical behaviour of radionuclei.** Rank, D. (Bundesversuchs- und Forschungsanstalt Arsenal, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

With regard to global propagation, the isotopes /sup 3/H, /sup 14/C, /sup 85/Kr and /sup 129/I set free within the fuel cycle are important. As an example for the geophysical behaviour of radionuclides the behaviour of /sup 3/H is considered and compared with measurements. 11 refs., 7 figs. (qui).

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 4266

5168 **(DOE/EH—0072) Environmental survey preliminary summary report of the defense production facilities.** (USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC. Office of Environmental Audit). Sep 1988. 489p. NTIS, PC A21. Order Number DE89003852/JAW.

This report contains the preliminary summary results of the Environmental Survey conducted at the Department of Energy (DOE) sites associated with the Department's defense production mission. The final product of the Survey will be the Environmental Survey Summary Report that is scheduled for completion during the fall of 1989. The Survey is being conducted by DOE's Office of Environment, Safety and Health (ES&H) to identify and rank environmental problems and areas of environmental risk at DOE's major operating facilities. This report is intended to provide preliminary information as to the relative ranking of the findings from the Environmental Survey at 16 sites involved in DOE's defense production mission based on potential impacts to public health and the environment. It also serves as a test of the ranking system that was designed as part of the Survey program and will be formally applied to all Survey findings when the final Survey report is written. While the results are not final, due to the absence of sampling and analysis input, they do provide DOE managers with useful preliminary information for use in long-range planning activities for environmental cleanup and improvements in pollution abatement capabilities. 19 figs., 37 tabs.

5106 Regulations

5169 **(PB—88-248133/XAB) Hazardous-waste inspections reference manual.** (Occupational Safety and Health Administration, Washington, DC (USA)). 1986. 276p. (OSHA/IS—88/008). NTIS, PC A13/MF A01.

This instruction manual establishes a National Emphasis Program (NEP) for the programmed inspection of Hazardous-Waste Sites, primarily found in Standard Industrial Classification (SIC) Code 4953, in accordance with the provisions of the Field Operations Manual. It includes OSHA hazardous-waste instruction directives; an overview of hazardous-waste-site information, encompassing environmental laws applicable to OSHA's hazardous-waste program, industry profile of RCRA Hazardous-Waste Management Facilities, Superfund sites, Selection of CSHO personal protective equipment, sampling at hazardous-waste sites, and frequent violations at some hazardous-waste facilities and sites; and OSHA Computerized Informations System (OCIS) User's Manual - the Hazardous-Waste Activities File.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5170 **(CEA-DAS—504) Simple and practical method for evaluating oceanic pollution.** Doury, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete). Aug 1988. 50p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755988/JAW.

The objective of this report is to give convenient and inexpensive tools which permit to obtain quickly evaluations of oceanic pollutions created by punctual sources in different diffusion conditions. With precautions the same tools can be used for nonoceanic pollutions. In all cases these evaluations can be taken in account the variability, in time, of the situations.

5201 Basic Studies

5171 **(BR—85(7.18)) The ecology of Tampa Bay, Florida: An estuarine profile.** Lewis, R.R. III; Estevez, E.D. (Mangrove Systems, Inc., Tampa, FL (USA); Mote Marine Lab., Sarasota, FL (USA)). Sep 1988. 132p. US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, LA 70458. Order Number TI89003026/JAW.

Tampa Bay is Florida's largest open-water estuary and one of the most highly urbanized. This report summarizes and synthesizes many years of scientific investigation into Tampa Bay's geology, hydrology and hydrography, water chemistry, and biotic components. The estuary is a phytoplankton-based system, with mangroves being the second most important primary producer. Benthic organisms are abundant and diverse, although in parts of the bay the benthos consists of a relatively few opportunistic and pollution indicator species. The estuary provides habitat for the juveniles and adults of a number of commercial and recreational fishery species. Significant changes occurring as a result of urbanization and industrialization include significant declines in intertidal wetlands and seagrass meadows, changes in circulation and flushing, and degradation of water quality. Important management issues include dredge and fill operations, restoration of fisheries, increasing freshwater flow to the bay, and eutrophication. 257 refs., 85 figs., 27 tabs.

5172 **(BR—85(7.20)) The ecology of rubble structures of the South Atlantic Bight: A community profile.** Hay, M.E.; Sutherland, J.P. (Fish and Wildlife Service, Washington, DC (USA)). Sep 1988. 79p. US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, Louisiana 70458. Order Number TI89002472/JAW.

This community profile provides an introduction to the ecology of the communities living on and around rubble structures in the South Atlantic Bight (Cape Hatteras to Cape Canaveral). The most prominent rubble structures in the bight are jetties built at the entrances to major harbors. After an initial discussion of the various kinds of rubble structures and physical factors that affect the organisms associated with them, the major portion of the text is devoted to the ecology of rubble structure habitats. Community composition, distribution, seasonality, and the recruitment patterns of the major groups of organisms are described. The major physical and biological factors affecting the organization of intertidal, sunlit subtidal, and shaded subtidal communities are presented and the potential effects of complex interactions in structuring these communities are evaluated. The profile concludes with a general review of the effects of rubble structures on nearshore sediment dynamics and shoreline evolution. 295 refs., 33 figs., 4 tabs.

5173 **(DOE/ER/60301—9) Pathogenic regulation of running water macroinvertebrates: Progress report, January 1--October 1, 1988.** Cummins, K.W.; Wilzbach, M.A. (Center for Environmental and Estuarine Studies, Frostburg, MD (USA). Appalachian Environmental Lab.). 1988. Contract FG05-85ER60301. 8p. NTIS, PC A02/MF A01. Order Number DE89003213/JAW.

The research focused on factors influencing mortality and growth in populations of stream macroinvertebrates. The research effort was partitioned into three areas of investigation including: Field sampling to establish potential mortality rates in the drifting and benthic components of natural populations, using the drift/benthos partitioner sampling device. A corollary of this work involves determining the nutritional history of the two population components. Laboratory studies of mortality and growth of individuals from the same egg clutch that are fed different quality foods. These studies involved holding larvae individually (or in groups of 5 or 10) in predator-free chambers in both the laboratory and the field. Examination of live, frozen, and fixed (buffered gluteraldehyde) specimens from lab cultures and field experiments for the presence of enteric pathogens. This research, which involves the use of facilities not on site at AEL, is still in progress.

5174 **(FWS/BR—88(12)) An ecological characterization of the Florida Panhandle.** Wolfe, S.H.; Reidenauer, J.A.; Means, D.B. (Department of the Interior, Washington, DC (USA); National Wetlands Research Center, Slidell, LA (USA); Minerals Management Service, New Orleans, LA (USA). Gulf of Mexico OCS Regional Office). Oct 1988. 298p. (OCS/MMS—88-0063). US Fish and Wildlife Service, 1010 Gause Blvd., Slidell, Louisiana 70458. Order Number TI89002136/JAW.

The Florida Panhandle extends from the Ochlockonee River basin west to the Florida-Alabama border and north to the Georgia and Alabama borders; it contains some of the most rapidly developing regions in the entire State. Because of the damaging effects of development, some attention must be given to the region's estuaries, coast, wetlands, and to habitats of endemic species. Development has already damaged some of these areas as well as the seagrass beds and oyster reefs of the western panhandle area. Other potentially affected areas include native upland ecosystems, salt marshes, river floodplains, and steephead areas. Research, growth management legislation, and consideration of the Florida Panhandle ecosystem as a whole are all necessary to ensure the future of the different Florida Panhandle areas. No steps can be taken or decisions made for their longevity until certain data gaps are filled; the gaps range from biological baseline studies of estuaries to the local impacts of rising sea level. 38 refs., 95 figs., 49 tabs.

5175 **(INIS-mf—11836) Water management in the field of tension of environmental protection.** Boehnke, B. (ed.). (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl und Inst. fuer Siedlungswasserwirtschaft). 1987. 811p. (In German). (CONF-8703297—). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88755413/JAW.

From 20. Essen meeting: water management in the field of tension of environmental protection; Aachen, F.R. Germany (11 Mar 1987).

Gewaesserschutz, Wasser, Abwasser.; no. 100.

The conference of March 1987, whose 35 papers are contained in this book, attempted a status report on municipal water management. Experts outlined the present situation, pointed out problems, and developed perspectives. Discussed were: Environmental protection, task and challenge; surface water quality - data - demands - perspectives; waste disposal instead of waste 'stage'; status report on planning and implementation of waste water purification using selected examples; solutions to problems of waste water purification. (HSCH).

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 4121

5176 **(DOE/ER—0383) Review of intermediate-scale experiments for subsurface microbiology and chemistry.** Streile, G.P.; Zachara, J.M.; Fredrickson, J.K. (Pacific Northwest Lab., Richland, WA (USA)). 1987. Contract AC06-76RL01830. 51p. (CONF-8704329—Summ.). NTIS, PC A04/MF A01. Order Number DE89001463/JAW.

From OHER/DOE workshop; Lewes, DE, USA (12 Apr 1987).

A workshop sponsored by the US Department of Energy (DOE) and Pacific Northwest Laboratory (PNL) was held at the University of Delaware's Virden Center in Lewes, Delaware, on April 12--14, 1987. The objectives of the workshop were to determine whether intermediate-scale experiments on subsurface microbiology and chemistry could advance scientific understanding of contaminant transport processes in groundwater, and the types of experiments that are needed at the intermediate scale to advance the state of the art. The term "intermediate-scale experiment" refers to an experiment that would be conducted in a system that is intermediate to the field and a laboratory batch reactor or column. Intermediate-scale experiments were more rigorously defined at the workshop as those focusing on processes and phenomena operative at the mesoscopic scale. The concept of intermediate-scale research was discussed, but not critically reviewed, at a previous workshop. 4 refs.

5177 **(GKSS—88/E/20) Provenance of the sediments and the suspended matter of the Elbe estuary.** Schwedhelm, E.; Knauth, H.D.; Salomons, W.; Schoer, J. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Chemie; Delft Hydraulic Lab., Haren (Netherlands). Inst. of Soil Fertility; Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik). 1988. 77p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755150/JAW.

The clay mineral composition, the concentration of carbonates, the proportions of carbon and oxygen isotopes in carbonates and organic matter as well as the concentrations of different elements have been used to determine the origin of several grain size fractions of the sediment and the suspended matter from the Elbe estuary. The results demonstrate the mixing between marine and fluvial sediments and transport of marine sediments past the salt wedge. Additionally, the different amounts of the upstream transport distance of the investigated grain size fractions support the hypothesis of settling and scour lag induced particulate transport. (orig.) With 29 figs., 25 tabs.

5178 **(GKSS—88/E/21) Nitrate removal by electrodialysis for brewing water.** Kneifel, K.; Luehrs, G.; Wagner, H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Chemie; Prozesstechnik Fluid G.m.b.H., Goslar (Germany, F.R.)). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1988. 8p. (CONF-8609453—). Special print from Desalination (1988) v. 68 p. 203-209.

From 5. international symposium on synthetic membranes in science and industry and 338. event of the European Federation of Chemical Engineering (EFCE-338); Tuebingen, F.R. Germany (2 Sep 1986).

From the example of a pilot operation in a brewery, it is demonstrated that electrodialysis is a reasonable process for removing nitrate from wellwater. The initial salt content of the raw water was 600 ppm total dissolved solids including 50 ppm nitrate and the total hardness was about 8 meq/l. Measurements indicate that after treatment the desired product water quality, i.e. 10 ppm nitrate and a residual hardness of about 2.5 meq/l, was achieved. The plant had a capacity of 24 m/sup 3//d and was operated mainly at a water

recovery rate of 80%. The costs for nitrate removal in an industrial plant were estimated to be 0.75-1.00 DM/m/sup 3/ product water, based on a plant capacity of 100 m/sup 3//d.

5179 **(GKSS—88/E/22) Field campaigns 1984 and 1985 (BILEX '84 and BILEX '85) on the upper tidal Elbe river for inflow-outflow balancing.** Michaelis, W.; Fanger, H.U.; Mueller, A. (eds.). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). 1988. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755151/JAW.

Continuing the series of field campaigns on the tidal Elbe river with the aim of inflow-outflow balancing the transport of suspended particulate matter and pollutants, two further experiments have been performed in atumn 1984 and in spring 1985 under quite different water discharge conditions. The area investigated covered the 22 km river section between the weir Geesthacht and Oortkaten. Along with the hydrographic measuring system HYDRA several trace analytical procedures and the numerical simulation model FLUSS were applied. In addition to the detailed data obtained during the campaigns, the annual discharge of suspended particulate matter and trace elements was determined on the basis of repeated sampling between and after the experiments. In summary, the results provide comprehensive information on the load of the river at the upper boundary of the tidal region as well as on the material transport into the branching area of the stream. Considerable progress has been achieved in modelling the transport processes. (orig.) With 39 figs., 30 tabs.

5180 (INIS-mf—11836, pp 395-409) **Deterioration in water quality due to pollutants in air and precipitation.** Staschen, G. (Umweltministerium des Landes Niedersachsen, Hannover (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88755413/JAW. (CONF-8703297—).

From 20. Essen meeting: water management in the field of tension of environmental protection; Aachen, F.R. Germany (11 Mar 1987).

Gewaesserschutz, Wasser, Abwasser.; no. 100.

The contribution reports on the causes and extent of water pollution already detected, the dangers to water supplies associated with acidification and the results of a survey carried out in Lower Saxony, with a concept for a programme of study and research. In detail, the paper deals with the following points of importance for water supply: Development of pollutant emission, deposition, pollutant transport in the ecosystem, dangers to water, first signs of water pollution and necessary work and measuring networks. (orig./HSCH).

5181 **(LA—11333-MS) Quality of surface and ground water at and adjacent to the Los Alamos National Laboratory: Reference organic compounds.** Purtymun, W.D.; Ferenbaugh, R.W.; Maes, M. (Los Alamos National Lab., NM (USA)). Aug 1988. Contract W-7405-ENG-36. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. Order Number DE88015055/JAW.

Surface and ground water samples were collected from 43 stations representing the major occurrences of natural and municipal water and industrial and sanitary effluents in the Los Alamos area. The samples were analyzed for volatile organics (35 compounds), semivolatile organics (65 compounds), base neutral acid fraction, pesticides (20 compounds), herbicides (3 compounds), polychlorinated biphenyls (7 compounds), and cyanides. The investigation was performed to find possible areas of organic contamination for further study; however, the impact of organic contamination in surface and ground water is minimal. A limited program of organic monitoring may be incorporated into the annual surveillance program for monitoring the quality of surface and ground water at and adjacent to the Los Alamos National Laboratory. 11 refs., 4 tabs.

5182 **(LA-UR—88-2071) Prediction methodology for contaminant transport from rangeland watersheds.** Devaurs, M.A.; Springer, E.P.; Lane, L.J.; Langhorst, G.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 27p. (CONF-881222—2). NTIS, PC A03/MF A01. Order Number DE88014420/JAW.

From ASAE international symposium on modeling agricultural, forest, and rangeland hydrology; Chicago, IL, USA (12 Dec 1988).

Weather on arid and semiarid lands can be extremely variable. Runoff is generally emphermeral, and high intensity, short-duration rainfall events are the major stimulus for runoff events. Transport of sediment and associated contaminants occurs with these infrequent events. Incorporation of variability in weather into any prediction technology is essential to provide accurate representations of climate-induced uncertainty in predictions of hydrologic response. The objective of this study is to investigate a method for including short-term climatic variations in analyses for contaminant transport from rangeland watersheds in arid/semiarid regions. Short term is defined here as a twenty to fifty time frame and it is assumed that lone term climatic fluctuations are not observed during this time. Also, most weather records are available for this time period; predictions of greater length are extrapolations of existing records unless corroborative data for longer term trends are collected. Predictions are being made with condensable uncertainty in the weather inputs even if the models for water, sediment, and contaminant transport are perfectly unknown. This study will incorporate uncertainty in weather inputs into the prediction process and address the ramifications of this uncertainty. Uncertainty introduced by improper model or parameter specification is only briefly addressed.

5183 **(LBL—25874) An analysis of selenium and chloride movement through a pond sediment at Kesterson Reservoir.** Long, R.H. (Lawrence Berkeley Lab., CA (USA)). Sep 1988. Contract AC03-76SF00098. 302p. NTIS, PC A14/MF A01 - OSTI. Order Number DE89003036/JAW.

Kesterson Reservoir, Merced County, CA, a disposal facility for agricultural drain water, became the object of intense scientific investigation after the discovery in 1983 that the disposal of Se-laden agricultural drain waters was having serious effects on the reproductive success of waterfowl. A remedial measure involving permanent flooding with low-Se water, aimed at taking advantage of low Se solubility under reducing conditions, was proposed as a means of limiting Se movement into groundwater and biota. A field experiment was undertaken to evaluate the feasibility of the proposed remedial measure, its impact on the quality of shallow groundwater and for quantifying Se immobilization and transport through a newly-flooded pond bottom soil. Extensive soil water and groundwater sampling demonstrated that although the soluble Se concentrations in the top 1.22 m of soil were initially as high as 1000s of μg L/sup {minus}1/, Se concentrations declined dramatically after flooding and elevated concentrations below 1.22 m were observed at only one of five sampling sites. Analysis of the temporal and spatial changes in the distribution of dissolved Se and Cl/sup {minus}/ indicated that 66--108% of the initial soluble Se present in the top 1.22 m was immobilized shortly after flooding. These estimates were consistent with the low Se concentrations observed in shallow monitoring wells. The extent to which Se immobilization occurred was found to correlate inversely with average pore water velocity. Redox measurements indicated that Eh conditions following flooding shifted sufficiently in magnitude and rate to conceivably account for the observed immobilization of selenium. Data presented suggest that reducing conditions in the newly flooded soils lead to the microbially mediated transformation of selenate to less soluble forms. 129 refs., 50 figs., 9 tabs.

5184 **(NP—9770102) Numerical tables of the physical and chemical investigations 1986.** (Arbeitsgemeinschaft der Laender zur Reinhaltung der Weser, Bremen (Germany, F.R.)). [1987]. 327p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE89770102/JAW.

The Arge Weser (Laender Association for Weser Water Quality Improvement), in which the Laender of Bremen, Hessen, Niedersachsen and Nordrhein-Westfalen are partners, has made regular measurements of the Fulda and Werra water quality since Jan-

uary 1, 1979. The new 'Messprogramm Weser' comprises the operation of continuous measuring stations in representative sites. Complete acquisition and recording of selected data and continuous sampling assure a better picture of the actual situation.

5185 **(PB—88-239959/XAB) Investigation of volatile organic chemical contamination in ground water near Rockton, Illinois.** Otto, S.; Michaud, G.; Morse, J. (Illinois Environmental Protection Agency, Springfield (USA). Div. of Land Pollution Control). Mar 1988. 75p. (IEPA/DLPC—87/014). NTIS, PC A04/MF A01.

Identifying a source of contamination based on sampling results from drinking water and monitoring wells can be confusing. Evaluations of ground-water sampling can lead to conclusions that are seemingly contradictory. The investigation notes key factors that may be useful to those studying volatile organic chemical (VOC) movement in sand and gravel outwash. Density of the contaminants, depth of well screens, and the varying hydraulic conductivities associated with heterogenous sediments must be considered before interpreting the results of groundwater samples. In this case, VOCs were detected in seventeen drinking-water wells in Blackhawk Subdivision near the village of Rockton. The subdivision is located at the confluence of the ancestral Pecatonica and Rock River Bedrock Valleys which are filled with thick outwash deposits. Groundwater movement in this area is complex due to the thickness and variety of sediments. The Illinois Environmental Protection Agency conducted an investigation to dettermine the source area of the contamination.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5152, 5153, 5165, 5167

5186 (INIS-mf—11328, pp 53) **Cs 137 transport into the pond vegation of Styria (Austria).** Ahamer, G.; Mueller, H. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik; Verein zur Foerderung der Anwendung der Kernenergie, Graz (Austria). Reaktorinstitut). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5187 (INIS-mf—11836, pp 411-428) **Radioactivity in surface waters and its effects.** Stoeber, I. (Ministerium fuer Umwelt, Raumordnung und Landwirtschaft des Landes Nordrhein-Westfalen, Duesseldorf (Germany, F.R.)). 1987. (In German). NTIS (US Sales Only), PC A99/MF A01. Order Number DE88755413/JAW. (CONF-8703297—).

From 20. Essen meeting: water management in the field of tension of environmental protection; Aachen, F.R. Germany (11 Mar 1987).

Gewaesserschutz, Wasser, Abwasser.; no. 100.

In consequence of the reactor accident in Chernobyl, the State Office for Water and Waste Disposal of North-Rhine Westphalia implemented immediate programmes for monitoring radioactivity in surface waters, including their sediments and organisms. Of the initially-measured radionuclides, only cesium-137, with its long half-life of 30 years, is of interest. Only trace amounts of the almost equally long-lived strontium 90 (half-life 28 years) were present in rainfall. Cs-137 is a non-natural-radionuclide, occurring solely as a by-product of nuclear installations and atomic bomb tests. Following the ban on surface testing of nuclear weapons, the Cs-137 content of surface waters had fallen significantly up to April 1986. The load due to the reactor disaster is of the same order of magnitude as that produced by atomic testing at the end of the nineteen-sixties. The paper surveys radioactive pollution of surface waters in North-Rhine Westphalia and its effects on water use, especially in regard to potable water supplies and the fish population. (orig./HSCH).

5188 (OEVS-Mitteilung—1/1988, pp 43-56) **Man-made radionuclides in surface waters.** Henrich, E.; Schoenhofer, F. (Bundesministerium fuer Gesundheit und Umweltschutz, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

Within the Austrian System for the Measurement of Environmental Radioactivity surface waters in Northeastern Austria are analysed on a routine basis in search of radioactive contaminations. Investigations by the Control and Measurement Unit found contaminations with chromium-51 and iodine-131, radionuclides widely used in medical applications. The annual transport of these nuclides is estimated to be in the range of several curies. 8 figs., 2 tabs.

5189 **(RISO-M—2746) Examination of the dilution of waterborne pollution from the German Bight to the Cattegat by means of radioactive tracers.** Aarkrog, A. (Risoe National Lab., Roskilde (Denmark)). Sep 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - Risoe Library, DK-4000 Roskilde. Order Number DE88755679/JAW.

Discharges of waterborne radioactive pollution (90Sr, 134Cs, and 137Cs) from European nuclear reprocessing plants may be used as oceanographic tracers. The present report shows how discharges from Cap de la Hauge in France were applied to estimate the transfer of pollution from the German Bight to the inner Danish waters (The Cattegat). About 40 percent of the bottom water in the Cattegat may arise from the German Bight.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 5229

5206 Regulations

5190 **(PB—88-245519/XAB) Review of the national ambient air-quality standards for sulfur oxides: updated assessment of the scientific and technical information. Final report.** (Environmental Protection Agency, Washington, DC (USA). Science Advisory Board). 19 Feb 1987. 5p. (SAB/CASAC—87/022). NTIS, PC A02/MF A01.

See also PB—86-221249.

This document is consistent in all significant respects with the scientific evidence presented and interpreted in the combined Air Quality Criteria Document for Particulate Matter/Sulfur Oxides (1982) and its 1986 Addendum, and that the Staff Paper and its Addendum provide the Administrator with the kind and amount of technical guidance that will be needed to make decisions with respect to the national ambient air-quality standards for sulfur oxides.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 5232

5191 **(IIUG-rep—86-1) International Institute for Environment and Society. Biennial report 1984-1985.** (Wissenschaftszentrum Berlin fuer Sozialforschung gGmbH (WZB) (Germany, F.R.). Internationales Inst. fuer Umwelt und Gesellschaft). 1986. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755397/JAW.

The cornerstone of the research conducted at the International Institute for Environment and Society (Internationales Institut fuer Umwelt und Gesellschaft, IIUG) is a programmatic concept of preventive environmental policy - an ex ante approach by society in dealing with the natural environment. The project areas and the individual projects of the institute's second program phase (1983-1987) are specifically related to this concept. In the period

under review (1984-1985), efforts at the IIUG were concentrated on implementing the research program. Although a number of other environmental problems have come to attract public interest, air pollution and measures for controlling it remain the prime issue in environmental policy. The current research program (1983-1987) of the IIUG encompasses four project areas: I. Environmental monitoring and assessment; II. Environmental impacts and environmental behavior; III. Evaluation of environmental policies; IV. Evaluation of selected policy areas from environmental perspectives. (orig./HSCH).

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 4423

5192 **(OE—8707) Review and update of bio-economic models of acid deposition.** (Ontario Ministry of the Environment, Toronto (Canada)). Jul 1987. 273p. (MICROLOG—88-00872). Ontario Ministry of the Environment, Communications Branch, 135 St. Clair Ave., West, 6th Floor, Toronto, Ont., Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1980-81, the Ontario Ministry of the Environment (MOE) commissioned the development of a set of computer models to estimate biophysical consequences of acid deposition and their economic implications. These models are reviewed and updated to reflect more currently available data and new research findings. The review and update focuses on three receptor categories: forestry, agriculture, and human systems. In addition, the deposition components of these models are reviewed and the model's structure evaluated. For each sector model, both the biophysical and the economic valuation components are examined. Recommendations for revisions cover methodology, data, and model parameters. Scientific information on the biophysical effects of acid deposition is still incomplete. In many cases dose-response relationships are still not available. The recommendations contained in this report, therefore, should be viewed as part of an on-going process to continually monitor available information and, when appropriate, incorporate it into the MOE models. The review suggests that the basic structure of the 1980 models be maintained, but that the specifics for each sector be revised. Implementation of this report's recommendations should encourage greater use of the models and provide up-to-date estimates of the economic effects of acid deposition. 96 refs., 17 figs., 6 tabs. categories

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 4559, 4560, 5201

5193 **(CONF-8706227—2) A biological approach to assessing environmental risks of engineered microorganisms.** Barnthouse, L.W.; Sayler, G.S.; Suter, G.W. II. (Oak Ridge National Lab., TN (USA)). [1987]. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE88016354/JAW.

From NATO advanced research workshop on risk analysis approaches for environmental releases of genetically engineered organisms; Rome, Italy (6 Jun 1987).

Because microorganisms in the environment are subject to the same physical laws that govern contaminant transport, it is feasible to adapt existing physical transport models for use with microorganisms rather than chemicals. There are, however, fundamental differences between microorganisms and toxic chemicals that lead us to question the applicability of contaminant-oriented risk assessment schemes to microorganisms. These differences suggest to us that a new conceptual approach to risk assessment is required for assessing environmental risks of microorganism releases, one that emphasizes the fundamentally biological nature of the phenomena involved. 19 refs.

5194 **(DOE/ER/13374—5) Regulation and genetic organization of hydrogenase: Final progress report for the period June 1, 1985--July 31, 1988.** Krasna, A.I. (Columbia Univ., New York (USA). Coll. of Physicians and Surgeons). Oct 1988. Contract FG02-85ER13374. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003031/JAW.

Hydrogenase is an enzyme which plays an important role in the anaerobic metabolism of many bacteria. The objectives of the research were to elucidate the regulation and genetic organization of hydrogenase in microorganisms. A mutation in the E. coli hydE gene leads to loss of all hydrogenase activities and isoenzymes as well as all formate-related activities. A 0.9 kb DNA fragment has been cloned from an E. coli genomic DNA library which restored all hydrogenase and formate activities to a hydE mutant strain. This gene coded for a polypeptide of subunit mw 36 kDa which is required for hydrogenase synthesis. It is involved in incorporation of nickel into hydrogenase. A mutation in the E coli hupB gene leads to the loss of the uptake of H_2 by dyes and the ability to grow on fumarate plus H_2, but expresses normal levels of hydrogenase when assayed by deuterium exchange. This mutation also leads to loss of all formate-related activities. The mutation mapped near minute 17 and a single mutation was responsible for loss of both activities. A 1.4 kb DNA fragment was isolated which restored the hydrogen uptake activities and coded for a polypeptide of subunit mw 30 kDa. Dna fragments have been isolated from Chromatium vinosum and Proteus vulgaris which restored hydrogenase activities to E. coli strains with mutations in the hydA or hydB regulatory genes and which lack all hydrogenase activities. 6 refs., 12 figs.

5195 **(IPEN-Pub—162) Purification of thyrotropin from human hypophysis: preliminary preparation.** Borghi, V.C.; Lin, L.H.; Bartolini, P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 18p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704278/JAW.

The adequacy of stored crude preparations for isolation of human tyrotropin (TSH) was evaluated according to Ross et al from a side fraction obtained during the purification of growth hormone from frozen pituitaries (SOMATORMON). Six crude TSH preparations were stored at - 20/sup 0/C during several years for further purification. One of these preparations was purified by sucessive chromatographies on Sephadex G-100, hydroxylapatite and SP-Sephadex C50. The TSH content present in the chromatographic fractions and in the pools was assayed by specific radioimmunoassay developed at our laboratory. The protein determination of the fractions and pools was performed by absorbance at 280 nm and by the method of Lowry at al, respectively. The TSH activity increased eight times during the purification and the TSH purified had a radioimmunological potency around half that de scribed by Roos at al. The results suggest the fitness of long time stored preparations in the attainment of pure TSH.

5196 **(LA-UR—88-3544) The National Laboratory Gene Library Project.** Deaven, L.L.; Van Dilla, M.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-8810209—6). NTIS, PC A02/MF A01. Order Number DE89002353/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

The two National Laboratories at Livermore and Los Alamos have played a prominent role in the development and application of flow cytometry and sorting to chromosome classification and purification. Both laboratories began to receive numerous requests for specific human chromosomal types purified by flow sorting for gene library construction, but these requests were difficult to satisfy due to time and personnel constraints. The Department of Energy, through its Office of Health and Environmental Research, has a long-standing interest in the human genome in general and in the mutagenic and carcinogenic effects of energy-related environmental pollutants in particular. Hence, it was decided in 1983 to use the flow construct chromosome-specific gene libraries to be made available to the genetic research community. The National Laboratory Gene Library Project was envisioned as a practical way to deal with requests for sorted chromosomes, and also as a way to promote increased understanding of the human genome

and the effects of mutagens and carcinogens on it. The strategy for the project was developed with the help of an advisory committee as well as suggestions and advice from many other geneticists. 4 refs., 2 tabs.

5197 **(UCID—21483) Creation of a plant molecular genetics capability at LLNL.** Marchant, Y.Y. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 16p. NTIS, PC A03/MF A01. Order Number DE89003424/JAW.

Recent conceptual and technical advances in plant molecular genetics and biotechnology can be used to minimize the impact of energy-related stressors on plants in the natural environment. This involves, among other possibilities, the development of plants resistant and/or tolerant to air pollutants, with a concomitant understanding of the effects of specific toxic gases on basic metabolic processes. Such a plant genetics capability was initiated at LLNL with Departmental IR&D funding. 10 refs., 7 figs.

5198 **(UCRL—98673) The mouse model for mutation in lymphocytes, cellular and molecular studies.** Jones, I.M.; Burkhart-Schultz, K.; Strout, C. (Lawrence Livermore National Lab., CA (USA)). 10 Oct 1988. Contract W-7405-ENG-48. 9p. (CONF-8810209—5). NTIS, PC A02/MF A01. Order Number DE89002660/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

Our research effort is focussed on understanding the mechanisms of somatic mutation in vivo. A critical initial goal of these studies is to identify the characteristics of particular target sequences that affect the types of mutations that can occur and be recovered in them. Knowledge of the types of mutations induced by test agents in specific target sequences will help us identify patterns of mutation that predict the consequences of exposures. By comparing the mutations in exposed and unexposed individuals we also may be able to identify mutations that serve as indicators of genetically significant exposures, and identify individuals at increased risk from particular exposures. Our mouse model system fills a major gap between work that can be performed in vitro and that performed in humans. By working in vivo, with mice, with cells analogous to those used in studies of humans, we are able to analyse factors such as tissue, dose rate, mutant persistence, and age, with target cells in their normal histological and physiological context, in animals with genetically defined metabolic and repair capacities, under controlled conditions of exposure.

5199 **(UCRL—98782) Human mutation monitoring using the glycophorin A-based somatic cell assay.** Bigbee, W.L.; Langlois, R.G.; Jensen, R.H. (Lawrence Livermore National Lab., CA (USA)). 10 Oct 1988. Contract W-7405-ENG-48. 9p. (CONF-8810209—3). NTIS, PC A02/MF A01. Order Number DE89002280/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

The results summarized here demonstrate that the glycophorin A (GPA) assay reveals an elevated level of spontaneous somatic mutation in cancer-prone individuals and that the assay responds in cases of acute high-dose exposures to chemical mutagens and radiation. The relationship between somatic genotoxicity and cancer risk is unknown. However, the spectrum of genetic alterations detectable in the assay have been shown to occur in human tumors. These include activation of oncogenes by point mutation and loss of functional alleles of tumor suppresser genes by gene deletion or inactivation, recombination or chromosome loss. Prospective studies are required to determine the utility of the assay for estimating cancer risk in situations of low-dose environmental and/or occupational exposures.

5200 **(UCRL—99810) Development of molecular approaches to the estimation of the germinal gene mutation rate in human populations.** Perry, B.A.; Mohrenweiser, H.W. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 9p. (CONF-881070—1). NTIS, PC A02/MF A01. Order Number DE89002934/JAW.

From Symposium on multi-level health effects research: molecules to man; Richland, WA, USA (17 Oct 1988).

In view of this potential for germinal mutations to result in genetic disease, it is important to establish a basis upon which to estimate the rate of occurrence of de novo gene mutations and the impact of mutagenic agents in increasing the frequency of these events. Estimates based upon a variety of approaches place the "spontaneous/background" germinal gene mutation rate in humans in the neighborhood of 0.4 {times} 10^{-5} events per locus per generation, or a nucleotide substitution rate of approximately 10^{-8} (Neel et al. 1988a) (70 substitutions/genome/generation). This rarity of events makes it difficult to establish a data base upon which to estimate the rate at which mutations occur. This is a reflection of the inability of current techniques to derive a significant amount of information from each subject and the unavailability of large cohorts for study (see Neel et al. 1988b). Thus, new approaches are required to derive the statistically-significant data bases necessary to detect an increase (or the absence of) in germinal gene mutation rate due to exposure to known or suspected mutagenic agents. 16 refs.

5504 Genetics

REFER ALSO TO CITATION(S) 5194, 5197

5201 **Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of {ital Homo sapiens}.** Cold Spring Harbor, NY; Cold Spring Harbor Laboratory (1986). 514p. Cold Spring Harbor Lab., Box 100, Cold Spring Harbor, NY 11724. Order Number TI88007793/JAW.

From 51. Cold Spring Harbor symposium on quantitative biology: molecular biology of Homo sapiens; Cold Spring Harbor, NY, USA (28 May 1986).

This volume is the second part of a collection of papers submitted by the participants to the 1986 Cold Spring Harbor Symposium on Quantitative Biology entitled Molecular Biology of {ital Homo sapiens}. The 49 papers included in this volume are grouped by subject into receptors, human cancer genes, and gene therapy. (DT)

5505 Metabolism

REFER ALSO TO CITATION(S) 5242

5506 Medicine

REFER ALSO TO CITATION(S) 4857, 5221

5202 (ACIESP—60-Vol.4, pp 59-68) **Clinical application of gastroenteropancreatic hormones (glucagon and gastrin) radioimmunoassay developed at IPEN-CNEN/SP: an overview.** Borghi, V.C.; Ginabreda, M.G.P.; Wajchenberg, B.L.; Bettarello, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil); Sao Paulo Univ. (Brazil). Faculdade de Medicina). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

A pancreatic glucagon and gastrin radioimmunoassays employing specific antiseruns were developed at IPEN. Both of the hormones were radioiodinated by the chloramine T technique and purified on QAE-Sephadex A25 to a specific activity of around 250 μCi/μg. The standard curves allowed measurements from 2 to 150 pmol/l with acceptable intra and inter-assay precision. Fasting glucagon levels determined in diabetics, obese subjects, acromegalics and patients with Cushing's syndrome were greater than in normals (6.3 +- 26 pmol/l; mean +- SD). Fasting gastrin values estimated in chagastics, patients with pernicious anemia, chronic renal failure and an unique patient with Zollinger-Ellinson's syndrome were greater than in normals (16.4 +- 15 pmol/l), while in the patients submitted to gastrectomy the gastrin leves were very low, as expected.

5203 (ACIESP—60-Vol.4, pp 69-81) **Application of a human thyrotropin purified from hypophysis at IPEN-CNEN/SP in the preparation of the radioimmunoassay tracer: [/sup 125/I]htSH.** Borghi, V.C.; Lin, L.H. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

This paper reports the isolation of thyrotropin (hTSH) from a side-fraction obtained during the purification of growth harmone at IPEN (Somatormon/sup R/ and stored at-20/sup 0/C since 1981. It also evaluates the adequacy of the hTSH-IPEN as labelled reagent in the radioimmunoassy (RIA) method in comparison to imported hormone supplied by the National hormone and Pituitary Program (Baltimore, Md., U.S.A.). The results suggest the fitness of long time stored crude preparations in the attainment of pure hTSH for labelling purposes and consequent use as reagent in RIA.

5204 **(AD-A—196880/9/XAB) Decision-Tree Network for the identification of nerve-agent treatments: reactivators. Summary report, August 1986-August 1987.** Southworth, G.C.; Sultan, W.E. (Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD (USA)). Apr 1988. 29p. (USAMRICD-TR—87-10). NTIS, PC A03/MF A01.

The Reactivator Decision Tree Network described is a screening procedure designed to rapidly identify potential replacements for the presently fielded acetylcholinesterase reactivator pralidoxime chloride (2-PAM). Selection of a replacement will be based on three factors: (1) improved efficacy against a broad spectrum of organophosphorus agents; (2) improved ability to alleviate agent-induced incapacitation; and (3) minimal side effects at therapeutic doses. This series of screening tests is designed only to select the most-promising candidates for advanced testing and is intended to be followed by more-complete safety and efficacy evaluations as a part of predevelopment advanced testing.

5205 **(BNL—52060) State of the art (and science) of blood cell labeling.** Srivastava, Suresh. (Brookhaven National Lab., Upton, NY (USA)). 18 Feb 1987. Contract AC02-76CH00016. 18p. NTIS, PC A03/MF A01. Order Number DE89003416/JAW.

In his lecture, Srivastava discusses his group's development of a medical kit for labeling human blood cells with the radioisotope technetium-99m. He describes Brookhaven National Laboratory's (BNL) past and present involvement as well as the future directions in blood cell labeling research. Technetium-99m was developed at BNL in the late 1950's. Its use for noninvasive diagnostic imaging grew in the 1960's after BNL developed a generator for hospitals to make their own technetium. Further research at BNL and at other places, resulted in the present widespread use of technetium-99m (more than 80% of all nuclear medicine imaging procedures involve its use). Kits developed at BNL label a variety of radiopharmaceuticals with technetium for the imaging of just about every organ system in the body. Using red blood cells, Srivastava explains various mechanisms for transporting technetium through a cell membrane and maintaining it within the cell. He discusses how monoclonal antibodies may eventually provide the best mechanisms for not only the future diagnostic imaging and treatment of tumors, but also for labeling specific blood cell populations in vivo. 12 figs., 10 tabs.

5206 (INIS-mf—11323, pp 7) **Cationic Tc compounds for the myocardial scintigraphy.** Seifert, S.; Syhre, R. May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

5207 (INIS-mf—11323, pp 7) **Technetium for brain examinations.** Spies, H.; Pietzsch, H.J. May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

5208 (INIS-mf—11323, pp 8) **/sup 99m/Tc complexes for renal function tests.** Johannsen, B.; Reiss, H.; Modersohn, D.; Strangfeld, D.; Spies, H.; Noll, B. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite); Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). May 1988. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88703055/JAW. (CONF-8805217—).

From Day colloquium of the Radioisotope Department; Dresden, German D.R. (30 May 1988).

5209 **(INIS-mf—11838) Investigations of nephrotoxicity caused by ionic and non-ionic contrast media in rats with previously damaged and not previously damaged kidneys and special view to urinary enzyme determinations.** Hofmeister, R. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Veterinaermedizin). 27 Jan 1988. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755951/JAW.

In this study ionic (meglumine amidotrizoate) and non-ionic contrast media (SHH 340 AB, Iohexol, Iopromide, Iosimide and Iopamidol) were tested for their nephrotoxicity in rats. During the experiment detections of urea nitrogen, serum creatinine and urinary enzymes as well as histological examinations of the kidneys were carried out for the diagnosis of acute renal damage. The results obtained in this study demonstrate that rats are not very sensitive to non-ionic contrast media with regard to kidney damage and determinations of urinary enzymes are valuable for the diagnosis of contrast media induced acute kidney damage in living animals.

5210 **(INIS-mf—11846) Clinical application and evaluation of the diagnostic significance of NMR-tomography. Final report.** Bielke, G.; Higer, P. (Gesellschaft zur Foerderung der Forschung an der Deutschen Klinik fuer Diagnostik e.V., Wiesbaden (Germany, F.R.); Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1987. 212p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755955/JAW.

Aim of the project was the clinical application and evaluation of the diagnostic significance of NMR-tomography. About 3 000 patients have been examined especially with diseases of the brain. In 75% of all cases pathological findings could be detected. A subgroup of these patients was used for comprehensive studies with regard to tissue characterization based on the calculation of relaxation time parameters. With methods of image processing and classification techniques we tried to get a clear correlation between combined NMR-parameters and human tissue types. The results show that this procedure is able to improve the detectibility and the association to finding groups and tumorgradings in certain cases. (orig./ECB) With 134 refs., 17 tabs., 86 figs.

5211 **(IPEN-Pub—161) Quality control of radioiodinated gastrin for radioimmunoassay.** Ginabreda, M.G.P.; Borghi, V.C.; Bettarello, A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jul 1988. 20p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704358/JAW.

Radioiodinated human gastrin has been prepared at IPEN laboratory for radioimmunoassay use. This work developed the quality control of this tracer analyzing parameters of the labelling reaction, chromatographic purification and radioimmunoassay. The radioiodination yield obtained in five experiments was reproducible and similar when analyzed on 7% polyaraylamide gel eletrophoresis - PAGE - (mean /sup +/- SD of 51.70 /sup +/- 10.76%) and by i/sup 25/I incorporation checked through thrichloroacetic acid precipitation - TCA - (57-36 /sup +/- 9.69%). Similary, after purification the labelled gastrin revaled high and reproducible purity degree when submitted to PAGE (96.57 /sup +/- 1.06%) and CA (94.82 /sup +/- 4.20%) analysis. The respective specific activities varied from 62 to 307 uCi/ug, being determined by the self-displacement method, which is based on the immunoactivity of the tracer. In this way, the antibody titers required to bind 50% of the tracer ranged from 1:32.000 to 1:180.000. Consequently, the respective doses producing 50% fall in the maximum response of the ra-

dioimmunoassays ranged from 155.0 to 24.0 pmol/1, but remained unchanged for each tracer even after three months of its preparations. The tracers presented very low non-specific binding values (1.78 /sup +/- 0.79%), stablespecific binding values (46.49 /sup +/- 5.65%) and a good between-assay precision, evaluated by an internal quality control sample (25.71 /sup +/- 4.30%) with coefficient of variation of 16.74%). The PAGE analysis of the unlabeled gastrin used in the first and last radioiodination revealed an unique and unaltered component, confirming the quality of the tracers.

5507 Microbiology

REFER ALSO TO CITATION(S) 4113

5509 Pathology

REFER ALSO TO CITATION(S) 5242

5520 Public Health

REFER ALSO TO CITATION(S) 5244, 5245, 5246

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 4278, 4821, 4823, 4828

5212 **(RISO-R—557) Availability of phosphorus in cow slurry using isotopic labelling technique.** Pongsakul, P.; Bertelsen, F.; Gissel-Nielsen, G. (Risoe National Lab., Roskilde (Denmark)). Jan 1988. 18p. NTIS (US Sales Only), PC A03/MF A01 - Risoe Library, DK-4000 Roskilde. Order Number DE88755681/JAW.

A pot experiment was conducted to evaluate the influence of cow slurry on P uptake by corn and to estimate the readily available P in the slurry by using an isotopic labelling techique. Water-soluble P in soil was increased and isotopic equilibrium of available P was attained after labelled slurry was mixed thoroughly throughout the soil. Labelled slurry applied at planting increased the P uptake by corn, whereas the same amount applied one week before harvest did not affect the P uptake. It was estimated that 46-54% of the total P uptake in plants is derived from the slurry. The readily available P (the L-value) in the slurry was at least 26 mg/kg which equals 3.7% of the total P.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 5222

5213 **(ACIESP—60-Vol.4) Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.** (Academia de Ciencias do Estado de Sao Paulo (Brazil)). 1988. 466p. (CONF-8808156—). NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW.

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

Some papers about application of radiation and radioisotopes and nuclear safety and radiation protection are presented. (E.G.).

5214 (ACIESP—60-Vol.4, pp 339-344) **Radiation protection at Centro Medico Naval Marcilio Dias during the assistance to the victims of the accident in Goiania.** Silva, L.H.C.; Rosa, R.; Fajardo, P.W. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The objective of this paper is to present the acquired experience in developing a radiation protection program to be implemented in case of an emergency medical assistance in radiological accidents.

5215 (ACIESP—60-Vol.4, pp 312-317) **Radiation property of sugar and its application to accidental dosimeter for inhabitants.** Nakajima, T.; Otsuki, T. (National Inst. of Radiological Sciences, Chiba (Japan)). 1988. (In Portuguese). NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The specifications of a dosimeter, using sugar as material are presented. This dosimeter will be used to measure radiation dose in contaminated persons. (E.G.).

5216 **(AERE-R—13204) Radiological Protection Research annual report 1988.** Wade, B. (UKAEA Harwell Lab. Environmental and Medical Science Div.). (UKAEA Harwell Lab.). 15 Jul 1988. 153p. H.M. Stationery Office, London, price Pound 22.00.

The 1987/88 programme cost about Pound 4M wholly funded by external organisations, mainly the regulatory authorities and the nuclear industry. In both staff and financial terms the RPR programme represents about 1% of the Authority's total programme. The programme carried out in 1987/88 falls into four broad areas: research on radiation effects in man, animals and cell cultures; the development of techniques of radiation dosimetry and the estimation of dose from measurable parameters; the study of environmental radioactivity at specific sites including Sellafield, Dounreay, Winfrith, the mechanisms of migration of radionuclides in the environment and the development of associated measurement techniques; and investigations relating to the accidental dispersion of radioactivity, (including Chernobyl). This research involved well over a hundred separate projects. Close liaison is maintained with other Authority programmes to take advantage of scientific synergy.

5217 **(DOE/ER—0371) Health physics/radiation protection enrollments and degrees, 1987.** (Oak Ridge Associated Universities, Inc., TN (USA)). Jun 1988. Contract AC05-76OR00033. 58p. NTIS, PC A04/MF A01; 1; GPO Dep. Order Number DE88013487/JAW.

The "Health Physics/Radiation Protection Enrollments and Degrees Survey, 1987" included 59 institutions with programs offering a major in health physics or an option within another major with equivalent course work which will prepare the graduate to take a major role in conducting, coordinating, directing, or planning a program for the evaluation and control of radiation hazards, i.e., programs which prepare graduates to perform as health physicists. This report discusses the results of this survey.

5218 **(DOE/ER/60455—3) Mechanisms for radiation damage in DNA: Progress report for the period June 1, 1988--May 31, 1989.** Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Nov 1988. Contract FG02-86ER60455. 13p. NTIS, PC A03/MF A01. Order Number DE89003257/JAW.

In this project we have proposed several mechanisms for radiation damage and recently radiation protection to DNA and its constituents, and have detailed a series of experiments utilizing electron spin resonance spectroscopy to test the proposed mechanisms. In the past we concentrated on investigating irradiated systems of DNA constituents. However, over the past several years we have included studies of spin labeled-DNA (and histone complexes), as well as radiation effects on sulfhydryls. In addition studies of radiation effects on lipids have been performed which shed light on the only other proposed site for cell kill, the membrane. In this years effort we have made several important scientific breakthroughs which have impact on the radiation protection provided by thiols as well as the oxygen enhancement effect. We have investigated the reactions of thiyl radicals with oxygen and found for the first time the thiol peroxyl radical and two other resulting sulfoxyl radicals which show differing chemistries. In addition the reactions of peroxyl radicals with thiols have been elucidated and we find this

chemistry extends to DNA itself, i.e., DNA peroxyl radicals readily react with thiols.

5219 (DOE/ER/60455—4) Mechanisms for radiation damage in DNA: Comprehensive report for the period, 1 June 1986--31 May 1989. Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Oct 1988. Contract FG02-86ER60455. 17p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003258/JAW.

Over the last three years, significant advances have been made in several areas of research resulting in 12 publications in the scientific literature. Some of these were as originally planned in the proposed effort of 1986 and in several cases new laboratory results have resulted in new and profitable directions. The most important recent work has been in the area of the interaction of thiyl radicals and oxygen as well as (DNA) peroxyl radicals with thiols. This work has given a wealth of information not known previously and may have important implications for radiation damage in vivo. This report also outlines some of the main features of the work performed over the past several years. 23 refs.

5220 (DOE/ER/60631—T2) The radiological research accelerator facility: Progress report for the period December 1, 1987--November 30, 1988. Hall, E.J. (Columbia Univ., New York (USA). Dept. of Radiation Oncology). Jul 1988. Contract FG02-88ER60631. 23p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89002681/JAW.

The Radiological Research Accelerator Facility (RARAF) is based on a 4-MV Van de Graaff accelerator, which is used to generate a variety of well-characterized radiation beams for research in radiobiology, radiological physics, and radiation chemistry. As such, RARAF is available to all potential users on an equal basis, and scientists outside the RRL are encouraged to submit proposals for experiments at RARAF. Facilities and services are provided to users, but the research projects themselves must be supported separately. Data obtained from experiments using RARAF have been of pragmatic value to radiation protection and to neutron therapy. At a more fundamental level, the research at RARAF has provided insight into the biological action of radiation and especially its relation to energy distribution in the cell. 12 refs., 2 figs., 4 tabs.

5221 (DOE/ER/60652—T1) 1988 Florida conference on chemistry in biotechnology conference report. (Florida Univ., Gainesville (USA). Dept. of Chemistry). 24 May 1988. Contract FG05-88ER60652. 9p. (CONF-8804185—Summ.). NTIS, PC A02/MF A01. Order Number DE88016267/JAW.

From Florida conference on chemistry in biotechnology; Palm Coast, FL, USA (26 Apr 1988).

This document describes the reports presented at a DOE funded conference. Topics included contrast agents for medical magnetic resonance imaging, medical diagnosis, radiopharmaceuticals, monoclonal antibodies, radionuclide-antibody conjugates, and covalent linkage of metal complexes to proteins. (TEM)

5222 (INIS-mf—11848) Sedimentation of nucleoids from thymus and spleen cells of rats after X-irradiation in vitro and in vivo. Heinzelmann, R. (Muenchen Univ. (Germany, F.R.). Tieraerztliche Fakultaet). 24 Jul 1987. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755956/JAW.

The reaction to irradiation of thymocytes was tested immediately and 6 hours after whole body X-irradiation of rats with doses from 190 cGy up to 1520 cGy by nucleoid sedimentation. For comparison, examinations of thymus and spleen cells after X-irradiation in vitro were done. Preliminary analyses should find a possible coergism between X-rays on one side and hyperthermia and inhibitors of DNA-synthesis or DNA-repair (cytosinearabinoside, dideoxythymidine, 3-amino-benzamide, ethidiumbromide, and novobiocine) on the other side. From the results the following conclusions may be drawn: 1) With respect to the detection of in vivo effects of X-irradiation, the nucleoid sedimentation is less sensitive than biochemical methods. 2) Some hours after sublethal X-irradiation in vivo, free DNA and/or polydesoxyribonucleotides appear. At the same time cross-links can be detected in the chromatin fraction. 3) The reduction of the nucleoid sedimentation immediately after high doses of whole-body irradiation is the result of primary DNA lesions. The changes detectable some hours after are due to the secondary enzymatic changes, that are connected with the interphase death of thymocytes, and coincide with the present opinions about the irradiation induced apoptosis of cells. (orig./ECB).

5223 (KFK—4452) Investigation of the soil-to-plant transfer of Np-237, Pu-238, Am-241 and Cm-244. Pimpl, M. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Aug 1988. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755974/JAW.

Inside a greenhouse for radioecological studies the root uptake of Np, Pu, Am, and Cm from 5 different soils into 19 crop plants have been measured. The soils have been artificially contaminated with the 4 nuclides in range from 1-20 Bq/g dry soil. Within 7 vegetation periods about 380 transfer measurements have been performed. The obtained results show that the soil-to-plant transfer is mainly influenced by the following parameters: physical and chemical properties of the different radionuclides, plant species and variety, soil type, time of soil utilization and soil management. The transfer factors measured are compared with those data which are proposed for the calculation of the long term radiation burden of the population by ingestion of contaminated food inside the Federal Republic of Germany. The experiments have been performed from the beginning of 1983 to the end of 1986. The results summarized within this report have already been published in annual reports or as contributions to scientific meetings.

5224 (KFK—4473) Early bone changes after incorporation of low quantities of alpha emitters in male rats. Laengle, U.W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen; Muenchen Univ. (Germany, F.R.). Tieraerztliche Fakultaet). Sep 1988. 153p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88755976/JAW.

This work shows the early effects of cancergenic doses of alpha emitters in long bones of rats. The investigations were based on radiographic, morphologic, angiographic, histologic and electronmicroscopic methods. A special method for bone angiography in the rat was elaborated and a new method was developed for measurement of the femur neck-head angle. Numerous disturbances in bone growth and bone structure, in the blood supply of bone and also of the bone building cells were observed. There was a correlation between the severity of the damage and the radiation dose, the spacial distribution of the nuclide and partially the age of the rats. The bone injury due to plutonium was markedly reduced by administration of the chelating agent Zn-DTPA.

5225 (LBL—25945) The effects on human populations of exposure to alpha-emitting radionuclides: The 1988 BEIR IV report. Fabrikant, J.I.; Ellett, W.H.; Cooper, R.D. (Lawrence Berkeley Lab., CA (USA)). 20 Jul 1988. Contract AC03-76SF00098. 22p. (CONF-8809137—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002922/JAW.

From 14. L. H. Gray conference; Oxford, UK (11 Sep 1988).

The BEIR-IV Report addresses health effects in human populations exposed to internally deposited alpha-emitting radionuclides and their decay products. Emphasis has been placed on the carcinogenic effects in humans and where possible, quantitative risk estimates for cancer induction are presented. The largest part of the Report concentrates on the health outcomes due to exposure to radon and its progeny. The Report also addresses health effects due to exposure to other groups of radionuclides and their progeny that emit alpha particles, viz., the isotopes of polonium, radium, thorium, uranium, and the transuranic elements. Lung cancer risk is derived from the epidemiologic surveys of underground miners who breathe high levels of radon-222 progeny. The risk of bone sarcomas is derived from the United States radium dial painters who ingested radium-226 and radium-228 and from German patients who received radium-224 for therapeutic purposes. The risk of head sinus carcinomas is obtained from the United States radium dial painters; the radon-222 gas and its progeny accumulated in the sinuses and mastoid air cells in workers with increased body burdens

of radium-226. The human data on liver cancer risk come mainly from Thorotrast patients who received colloidal thorium-232 dioxide and its progeny during medical procedures. 6 ref., 2 tabs.

5226 **(ORNL/TM—10971) Proceedings of the second conference on radiation protection and dosimetry.** Swaja, R.E.; Sims, C.S. (eds.). (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 230p. (CONF-881032—). NTIS, PC A11/MF A01. Order Number DE89001663/JAW.

From 2. conference on radiation protection and dosimetry; Orlando, FL, USA (31 Oct 1988).

The Second Conference on Radiation Protection and Dosimetry was held during October 31--November 3, 1988, at the Holiday Inn, Crowne Plaza Hotel in Orlando, Florida. This meeting was designed with the objectives of promoting communication among applied, research, regulatory, and standards personnel involved in radiation protection and providing them with sufficient information to evaluate their programs. To facilitate meeting these objectives, a technical program consisting of more than 75 invited and contributed oral presentations encompassing all aspects of radiation protection was prepared. General topics considered in the technical sessions included external dosimetry, internal dosimetry, calibration, standards and regulations, instrumentation, accreditation and test programs, research advances, and applied program experience. In addition, special sessions were held to afford attendees the opportunity to make short presentations of recent work or to discuss topics of general interest. This document provides a summary of the conference technical program and a partial collection of full papers for the oral presentations in order of delivery. Individual papers were processed separately for the data base.

5227 **(PNL-SA—15981) Problems with detection of intakes of very insoluble plutonium.** Bihl, D.E.; Lynch, T.P.; Carbaugh, E.H.; Sula, M.J. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1988. Contract AC06-76RL01830. 5p. (CONF-8810112—5). NTIS, PC A02/MF A01. Order Number DE89001991/JAW.

From 34. annual conference on bioassay, analytical and environmental radiochemistry; Las Vegas, NV, USA (17 Oct 1988).

Several human cases involving inhalation of plutonium oxide at Hanford have shown clearance half-times from the lung that are much longer than those recommended for class Y material in Publication 30 of the International Commission on Radiological Protection (ICRP 1979). Because the material is much more tenaciously retained in the lung than "normal" class Y material, the Hanford Internal Dosimetry Program has been referring to it as "super" class Y. This material poses some major challenges with regard to the design and operation of bioassay monitoring programs. Because of the relative completeness of their data, 10 cases that show lung retention half-times in excess of 5000 days are of particular interest. However, the bioassay data for these cases span the past 30 years and involve various sampling methods and detection limits in vogue at the time. Furthermore, the data were collected for the purpose of determining compliance with regulations in place at the time, rather than for research or modeling of clearance pathways and rates. So from a modeling perspective, the data have gaps, but are sufficiently complete to be convincing. 3 refs., 2 figs., 2 tabs.

5228 **(PNL-SA—16336) Radon risks in animals with reference to man.** Gilbert, E.S.; Cross, F.T. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 19p. (CONF-8810209—2). NTIS, PC A03/MF A01. Order Number DE89001478/JAW.

From 27. Hanford life sciences symposium on health and the environment; Richland, WA, USA (18 Oct 1988).

Radon inhalation studies in animals provide important supplementary information to human data. Because the measurement of exposure characteristics in experimental studies is more accurate than in epidemiological studies, animal studies may provide a more reliable assessment of the dependence of risks on radon-daughter cumulative exposure. Experimental data have also provided information on the dependence of risks on radon-progeny exposure rate, unattached fraction, and disequilibrium, as well as on concomitant exposures to cigarette smoke. A summary of radon studies in animals has been published. Two examples of results from these studies are included; in both cases, results were based on the percent of animals with lung tumors. 8 refs., 4 figs., 3 tabs.

5602 Thermal Effects

5229 **(INIS-mf—11797) Effects of waste heat from Unterweser nuclear power plant on the biocenoses of the lower Weser river. Pt. 2. Investigation period November 1978 to November 1982.** Vobach, M.; Feldt, W. (Bundesforschungsanstalt fuer Fischerei, Hamburg (Germany, F.R.). Lab. fuer Radiooekologie der Gewaesser). Sep 1987. 136p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755402/JAW.

Berichte aus dem Isotopenlaboratorium der Bundesforschungsanstalt fuer Fischerei Hamburg.; no. 5.

After the commissioning of the power station, investigations were carried out on th fish, the fauna of benthos, the phytoplankton and zooplankton of the Lower Weser from November 1978 to November 1982. Furthermore the annual average of headwater discharge rate and the monthly average of water temperature, oxygen content and salt content were determined. This report completes the investigations carried out after the commissioning of the nuclear power station Unterweser (KKU). The effect of sewage effluent heat of the nuclear power station Unterweser on the biocenosis is presented in a third volume after comparing the results of the submitted report with those of the report on the period before the commissioning of the nuclear power station KKU (1).

5603 Chemicals Metabolism And Toxicology

REFER ALSO TO CITATION(S) 5133, 5134, 5159

5230 **(DOE/ER/60654—1) Determination of the cell and mucous distribution in the airways of the lung: Progress report.** Mercer, R.R. (Duke Univ., Durham, NC (USA). Medical Center). 1988. Contract FG05-88ER60654. 7p. NTIS, PC A02/MF A01. Order Number DE89003289/JAW.

During the 5 months since the beginning of this project we have made significant progress in carrying out the project goals including: The fixation, embedding and airway dissections of lungs from the Sprague Dawley rat; The study of airway cell distributions in lung specimens of the Sprague Dawley rat; The commencement of the determination of mucous depth, composition and distribution in the airway dissections of the Sprague Dawley rat; Two surgical resection specimens from normal nonsmoking middle aged adults have been obtained; and in collaboration with Dr. Werner Hoffmann, one of the leaders in development of dosimetry models for radon, we have determined several enhancements in the morphometric analysis of airway cell distributions which will make our results more amendable to modeling efforts and result in more accurate prediction. 7 figs.

5231 **(DOE/EV/10449—T1) Toxic organic compounds from energy production: Final report.** Hites, R.A. (Indiana Univ. Foundation, Bloomington (USA)). Aug 1988. Contract AC02-80EV10449. 24p. NTIS, PC A03. Order Number DE89002730/JAW.

The DOE's Office of Health and Environmental Research has supported a program in Professor Hites' laboratory since 1977. The theme of this program has been identifying potentially toxic organic compounds associated with various combustion effluents, following the fates of these compounds in the environment, and improving the analytical methodology for making these measurements. We have focused on groups of compounds known to be toxic and known to be associated with energy production. These include the polyhalogenated dioxins which are produced by the combustion of refuse derived fuel and polycyclic aromatic hydrocarbons which are produced by the combustion of almost anything. Our study of the fates of these compounds has lead us into photochemistry and indoor air pollution. 7 refs., 12 figs., 2 tabs.

5232 (KFK-PEF—35-Vol.2) **4. status colloquium of the European Research Centre for Air Pollution Control Measures (PEF).** Horsch, F.; Filby, W.G.; Fund, N.; Gross, S.; Hanisch, B.; Kilz, E.; Seidel, A. (comps.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). Apr 1988. 435p. (In German). (CONF-8803158—Vol.2). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW.

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

During March 8-10, 1988 the Fourth Status Report of the Project 'European Research Centre for Air Pollution Control Measures' took place at the Nuclear Research Center Karlsruhe. Progress reports on the following topics - assessment and analysis of the impacts of airborne pollutants on forest trees; distinction from other potential causes of recent forest dieback (Task 1A) - air pollution effects on human health (Task 1C) - research into atmospheric dispersion, conversion and deposition of airborne pollutants (Task 2) - development and optimization of industrial-technical processes to reduce or avoid emissions (Task 3) - providing instruments and making recommendations to the industrial and political sectors (Task 4) were presented. The presentations contained in this volume comprise the subject matter of tasks 1C, 2, 3, 4.

5233 (KFK-PEF—35-Vol.2, pp 399-410) **Biochemical investigations on the influence of inhalable particles on lysosomes from alveolar macrophages.** Seidel, A.; Drosselmeyer, E.; Hotz, G.; Paetzold, S.; Polzer, G.; Schimmelpfeng, J.; Wilczek, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Genetik und Toxikologie von Spaltstoffen). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Lysosomes from bovine alveolar macrophages were characterized by electron microscopic methods. As shown by carrier-free electrophoresis bovine alveolar macrophages consist of several subpopulations, which also differ in their specific content of lysosomal enzymes. The separation between the populations is better after 20 hours culture than immediately after bronchoalveolar lavage. After incubation with quartz the slowly migrating fractions disappear completely. This effect is lacking after incubation with TiO/sub 2/ or when quartz had been treated with lecithin. The reaction of bovine alveolar macrophages towards quartz or TiO/sub 2/ is very similar to that of (alveolar) macrophages from different species. First results with subcellular organelles from bovine alveolar macrophages indicate that a specific binding of lysosomal membranes but not of enzymes occurs.

5234 (KFK-PEF—35-Vol.2, pp 411-423) **Damage to human lung cells by inhalation noxes.** Ebert, W.; Mayer, D.; Vogt-Moykopf, I. (Thoraxklinik Heidelberg-Rohrbach (Germany, F.R.)). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Cell mortality of cultivated human pneumocytes (A-549) was determined via trypan blue dying of damaged cells after application of toxic gases (ozone or nitrogen dioxide) to the cultures. Cytotoxicity could be reproducibly decreased by the addition of the following antioxidative compounds to culture media (HAM's F 12 K-medium): D,L-alpha-tocopherol (10 μg/ml), histidine (2 mM) and superoxide dismutase (100 units/ml). Whereas only tocopherol had a cytoprotective effect in regard to ozone immissions, reducing cell mortality by 12%, superoxide dismutase and histidine diminished mortality during NO/sub 2/-application (by 55% and 6%, respectively).

5235 (KFK-PEF—35-Vol.2, pp 425-437) **Effects of irritant gas-induced damage of bronchial epithelium (SO/sub 2/, NO/sub 2/, ozone, cigarette smoke) on sensitization by inhaled allergens.** Riedel, F.; Rieger, C.H.L. (Marburg Univ. (Germany, F.R.). Zentrum fuer Kinderheilkunde). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The effect of irritant gas induced damage of bronchial mucosa on local bronchial sensitization to inhaled allergens (ovalbumin, house dust mite) was studied in the guinea pig. At present short period exposures over 8 hours on 5 consecutive days with SO/sub 2/ (0,1 - 4,3 - 16,6 ppm) and NO/sub 2/ (0,95 - 5,0 - 45,0 ppm) as well as continuous long term exposures over 3 weeks with 0.06 and 0.2 ppm SO/sub 2/ were performed. Antigen inhalation (0.1% Ovalbumin) following irritant gas exposure induced specific local bronchial sensitization in all exposed animals, which was not found in air exposed control animals. Specific sensitization was investigated by bronchial reactions in specific allergend provocation tests using bodyplethysmographic methods, and immunologically by antigen specific antibodies in serum and bronchoalveolar fluid. The degree of sensitization was partly correlated to irritant gas concentration, with high exposure concentration (16.6 ppm, 45. pppm NO/sub 2/) no further increase of sensitization was noticed. Inhalation of house dust mite antigen after exposure did not induce sensitization, a preexisting sensitization is discussed. Further studies on ozone and tobacco smoke using ovalbumin and other inhalation antigens (birch) are being performed.

5236 (KFK-PEF—35-Vol.2, pp 439-454) **Analysis of bronchoalveolar lavage proteins as a marker for cellular injury in terminal lung tissue due to inhalative noxes.** Mueller, B.; Wichert, P. von. (Marburg Univ. (Germany, F.R.). Medizinische Poliklinik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Rats were exposed to increasing concentrations of nitrogen dioxide that caused enhencement of phospholipid and protein as well as increase of granulocytes in the bronchoalveolar lavage. The parameter that was changed first in the bronchoalveolar lavage was the surfactant-specific apoprotein SP 26-36. Further analyses on surfactant-producing pneumocytes II revealed that the biosynthesis of the phosphatidylcholine was affected: The cellular content of the intermediate products (choline-phosphate, CDP-choline, and the final phosphatidylcholine) was diminished as well as the activity of the involved enzymes choline-kinase and the choline-phosphate-cytididyltransferase). Our hypothesis that the determination of specific apoproteins in bronchoalveolar lavage material as a marker for cellular injury could be regarded verified. - Additional experiments concerning biosynthesis of dipalmitoyl-phosphatidylcholine ('remodeling-pathway') and secretion of phospholipids and specific proteins are in progress to analyze further cellular mechanisms of NO/sub 2/ influence on terminal lung tissue.

5237 (KFK-PEF—35-Vol.2, pp 455-465) **In vitro and in vivo studies of the carcinogenic, toxic and genotoxic activities of the air pollutants SO/sub 2/ and NO/sub x/, separately and in combination with carcinogenic polycyclic aromatic hydrocarbons and N-nitrosamines.** Zeller, W.J.; Klein, R.G.; Pool, B.L.; Schmezer, P. (Deutsches Krebsforschungszentrum, Heidelberg (Germany, F.R.). Inst. fuer Toxikologie und Chemotherapie). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

In the course of our studies directed at elucidating biological effects of the air pollutants SO/sub 2/ and NO/sub x/ it was found, that the activity of lactate dehydrogenase (LDH) is inhibited by

SO/sub 2/. This effect was observed in vitro and in vivo and is based on a sulfite- and not on a sulfate-mediated action. NO/sub x/ and SO/sub 2/ reduce DNA single strand breaks induced by B(a)P in fetal hamster lung cells in vitro and SO/sub 2/ reduces DNA single strand breaks induced by AMMN in primary cultures of rat hepatocytes. The postulated mechanisms of action are discussed. Sulfite itself induces DNA-amplification in SV40 transformed CO60 cells; but an increase in the amplification rate induced by B(a)P or 7,12-DMBA was not observed. The in vitro genotoxicity (DNA single strand breaks) of 3 nitrosamines (AMMN, NDMA, NMBzA) is reduced in rat hepatocytes from donor animals pretreated with 50 ppm SO/sub 2/ for 2 weeks. Inhalation of NO/sub x/ by rats reduced the activities of AHH, NDMA-D and GST in hepatocytes and of GST in lung cells. Following SO/sub 2/ inhalation NDMA-D activity in the liver is increased and GST activity in the lung is decreased. In a current in vivo long-term inhalation study of NDMA+-SO/sub 2/ or NO/sub x/ first tumors of the nasal cavity are already observed after a total dose of 2 mg NDMA/animal.

5238 (KFK-PEF—35-Vol.2, pp 477-488) **Effects of outdoor and indoor air pollution on lung function, hyper-reactivity, risk of pulmonary disease and course of disease.** Eltschka, R.; Matthys, H. (Freiburg Univ. (Germany, F.R.). Abt. Pneumologie). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The research project under discussion has been launched to gain new insights into etiopathogenesis of hyperreactivity in bronchial asthma and chronic bronchitis, by taking into account the effects of indoor and outdoor pollution on the respiratory system. By means of intensive global and individual monitoring the effects of pollution on respiratory diseases, their course and progression to an invalid status with persons of defined risk groups will be evaluated. Thus important environmental noxes can be defined. Prognostic parameters, early diagnosis, allocation of persons into risk groups, exact observation of progredient course, and - in case of sickness - an adequate therapy, are supposed to prevent the course of the disease and an early invalidity.

5239 (KFK-PEF—35-Vol.2, pp 489-502) **Air pollution, bronchial hyper-reactivity and bronchial pulmonary disorders in children and adults.** Kuehr, J.; Hendel-Kramer, A.; Stephan, V.; Urbanek, R.; Karmaus, W. (Freiburg Univ. (Germany, F.R.). Universitaets-Kinderklinik; Hamburg Univ. (Germany, F.R.). Inst. fuer Medizinische Soziologie). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

800 school aged children and their parents are involved in the initial transversal part of the study. Following parameters are investigated: Lung function test as pneumotachography, the estimation of airways hyperreactivity by carbachol challenge and skin prick test with the most important inhalant allergens. In addition, a standardized questionnaire on personal and familiar history, social status and potential indoor air pollutants exposure (heating, smoking habits, characteristics of the house, furnishing) is completed by a trained interviewer. The transversal follows a longitudinal part of the study, a 2,5 year observation period with annual reexamination of all patients. To evaluate the parthogenetic relevance of indoor air pollutants 120 persons were observed in an imbedded case-control-study. Indoor pollutant levels (SO/sub 2/, NO/sub x/ and dust) are monitored by means of passive sampling method in weekly intervals. An additional evaluation of meteorological data according to the geographic location (Rhein valley and Black Forest area) is performed. Indoor and outdoor factors will be correlated with the incidence and follow up of bronchopulmonary disorders in children and their parents.

5240 (KFK-PEF—35-Vol.2, pp 513-522) **Dose-response-relation between croup syndrome/obstructive bronchitis and ambient air pollution in Baden-Wuerttemberg.** Wichmann, H.E.; Beckmann, M.; Huebner, H.R.; Malin, E.M.; Rebmann, H.; Pizard-Weyrich, M.; Hippke, G.; Doeller, G.; Herrmann, S. (Medizinisches Inst. fuer Umwelthygiene, Duesseldorf (Germany, F.R.); Tuebingen Univ. (Germany, F.R.). Kinderklinik; Kreiskrankenhaus Freudenstadt (Germany, F.R.); Olga-Hospital, Stuttgart (Germany, F.R.); Tuebingen Univ. (Germany, F.R.). Abt. fuer Medizinische Virologie und Epidemiologie der Viruskrankheiten; Medizinisches Landesuntersuchungsamt, Stuttgart (Germany, F.R.)). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

The data collection for the epidemiologic study which started in January 1986 has been completed. In Stuttgart, Tuebingen/Reutlingen/Rottenburg and Freudenstadt 188 physicians and 3 hospitals participated in the longitudinal study and more than 3000 cases of croup syndrome or obstructive bronchitis were reported. In the cross-sectional study the parents of more than 8000 children filled in a questionnaire, which corresponds to a response rate of about 90%. Of the positive virologic isolations approximately 50% were RS-viruses, 25% parainfluenza-viruses and 16% influenze-viruses. Parainfluenza viruses had their maximum during fall as croup syndrome had. In contrast RS-viruses were isolated more frequently in spring where also an increase of obstructive bronchitis was reported. During the winter of 1986 an epidemics of influenza B coincided with elevated numbers for both deseases. Statistical analysis of the data with respect to ambient air pollution is in process.

5241 (KFK-PEF—35-Vol.2, pp 651-662) **Recent investigations of the relation between surface structures of leaves or needles and the uptake of air pollutants.** Schreiber, H.; Rentschler, I. (Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Physik). Apr 1988. (In German). NTIS (US Sales Only), PC A19/MF A01. Order Number DE88755155/JAW. (CONF-8803158—Vol.2).

From 4. annual report of the Research Programme for Air Pollution Prevention Measures of Kernforschungszentrum Karlsruhe G.m.b.H.; Karlsruhe, F.R. Germany (8 Mar 1988).

Recent investigations of the relation between surface structures of leaves or needles and the uptake of air pollutants. Three compartments of a tree: The surface layer of needles, the innerpart of them and the corresponding segments of the bark were investigated for some elements by X-ray fluorescence analysis. The results have been combined with morphological and geometrical data of a young spruce to gain the total contents in the different compartments. It could be shown that for Pb, Cu and Fe the bark compartment contributes the main part of the contents in a canopy of spruce trees. Differences in the surface structure of the waxy layer should be characterized in a quantitative measure. We tried to apply the statistical method of spectral analysis on line scans of the scanning-microscope. The results prove the suitability of this tool to satisfy the need for objective data of the surface structure.

5242 **(KFK-PEF—41) Phytohormone balance in healthy and diseased conifers.** Frenzel, B.; Beuther, E.; Christmann, A.; Damsohn, W.; Flachmann, M.; Gepraegs, P.; Gueth, S.; Haas, K.; Huckriede, U.; Kettnaker, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Europaeisches Forschungszentrum fuer Massnahmen zur Luftre). Dec 1987. 212p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE88755399/JAW.

The symptoms of forest decline point to disturbances in the equilibrium of various hormones. Starting from reliably healthy trees extent and development of these deviations were examined in sick trees. This was at first done as to ethylene and abscisic acid, as well. Both these hormones display already in needles of healthy trees remarkable changes in their contents depending on age and ecological situation of the tree examined. This is camouflaged by other changes in sick trees, this being different from those changes, which are caused by strong SO/sub 2/-immissions. Since the same

holds true for other plant-physiological and ultrastructural characteristics, it is concluded that the recent forest decline and damages caused by SO/sub 2/-immissions are different things. (orig.) With 86 figs., 137 refs.

5243 **(LA—11447) A preliminary report on zinc-induced resistance to nitrogen mustard toxicity in mice.** Shackelford, M.E.; Tobey, R.A. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 15p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003458/JAW.

Previous studies with cultured human normal fibroblasts indicated that treatment of cells with zinc before exposure to alkylating agents enhanced cell survival by seven- to nine-fold. To establish whether a similar zinc-induced protective response could be elicited in vivo, a set of preliminary experiments was carried out in which Balb/cJ mice were treated with zinc chloride (2 mg/kg body weight) or saline by intraperitoneal (ip) injection at 48, 36, 24, and 12 h before ip administration of 4 mg/kg of the alkylating agent nitrogen mustard. Of the animals that received saline before nitrogen mustard, 57% were killed compared with only 20% in the group treated with zinc before administration of the alkylating agent. These results (which almost certainly were achieved with less than optimal induction conditions) provide evidence for the existence, in vivo, of a zinc-inducible process that reduces alkylating agent lethality. 12 refs., 4 figs.

5244 **(PB—88-243837/XAB) Health and Environmental Effects Profile for hexachlorophene.** (Environmental Protection Agency, Cincinnati, OH (USA). Office of Environmental Criteria and Assessment). Mar 1986. 117p. (EPA—600/X-86/085). NTIS, PC A06/MF A01.

The Health and Environmental Effects Profile for Hexachlorophene was prepared to support listings of hazardous constituents of a wide range of waste streams under Section 3001 of the Resource Conservation and Recovery Act (RCRA) and to provide health-related limits for emergency actions under Section 101 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Both published literature and information obtained from Agency program office files were evaluated as they pertained to potential human-health, aquatic-life, and environmental effects of hazardous-waste constituents. Quantitative estimates are presented, provided sufficient data are available. Hexachlorophene was been determined to be a systemic toxicant. The amount of a chemical to which humans can be exposed on a daily basis over an extended period of time (usually a lifetime) without suffering a deleterious effect, for hexachlorophene is 0.001 mg/kg/day for oral exposure. The Reportable Quantity (RQ) value for hexachlorophene is 100.

5245 **(PB—88-248109/XAB) Regulatory impact and regulatory flexibility analysis of the formaldehyde standard.** (Occupational Safety and Health Administration, Washington, DC (USA)). 20 Nov 1987. 232p. (OSHA/IS—88/005). NTIS, PC A11/MF A01.

In response to a petition from the United Auto Workers (UAW) and 13 other unions, the Occupational Safety and Health Administration (OSHA) is revising its standard covering occupational exposures to formaldehyde as an 8-hour time-weighted average (TWA) is being lowered to 1 ppm. The current ceiling concentration of 5 pmm averaged over 30 minutes is also being revised to a short-term exposure limit (STEL) of ppm averaged over 15 minutes. In addition, a number of new requirements (including monitoring, training, personal protective equipment, and medical surveillance) were created, which are triggered at various levels of formaldehyde exposure.

5246 **(PB—88-248117/XAB) Final regulatory impact and regulatory flexibility analysis of the benzene standard.** (Occupational Safety and Health Administration, Washington, DC (USA)). 29 Apr 1987. 221p. (OSHA/IS—88/006). NTIS, PC A10/MF A01.

The present standard for occupational exposure to benzene (29 CFR Part 1910.1000, Table Z-2) was adopted by the Occupational Safety and Health Administration (OSHA) in 1971 from an earlier American National Standards Institute (ANSI) standard under the authority of section 6(a) of the Occupational Safety and Health (OSH) Act of 1970. The ANSI standard set an 8-hour time-weighted average (TWA) permissible exposure limit (PEL) of 10 parts benzene per million (10mm) parts of air and was based on findings that exposure to benzene could result in aplastic anemia and other blood dyscrasias as well as acute and chronic health effects. Neither the ANSI nor the OSHA standard considered a relationship between leukemia and benzene exposure.

5247 **(UCRL—21001-88-5) Comparison of the response of mature branches and seedlings of{ital Pinus ponderosa} to atmospheric pollution: Progress report.** Houpis, J.L.J.; Surano, K.A.; Costella, M.P. (Lawrence Livermore National Lab., CA (USA)). Jul 1988. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01. Order Number DE89002932/JAW.

During this period, we concluded our travel schedule with a visit to the Boyce Thompson Institute for Plant Research. We also made extensive progress on the construction of the branch exposure-chamber (BEC) prototype as well as on the initial testing of the chamber environment and equipment. Such testing resulted in modification and improvement of the original BEC prototype designs. We also conducted an extensive literature review of previous chamber designs. These items are covered in detail in this Progress Report. 18 refs., 4 figs., 6 tabs.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 4438, 4681

5248 **(CEGB-TPRD/L—3270/R88) Effect of fish impingement at Sizewell 'A' Power Station, Suffolk, on North Sea fish stocks.** Turnpenny, A.W.H.; Utting, N.J.; Millner, R.S.; Riley, J.D. (CERL Marine Biology Unit, Fawley (GB); Ministry of Agriculture, Fisheries and Food, Lowestoft (UK)). (Central Electricity Research Labs., Leatherhead (UK)). Apr 1988. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755479/JAW.

Samples collected from the cooling water intake screens of Sizewell 'A' power station over a 12 month period contained 73 species of fish. Of these, only 20 species were present on more than 50% of sampling dates and only 7 commercially exploited species were caught in quantities of more than a few hundred over the year; namely sprat, herring, cod, whiting, sole, dab and plaice. These species formed the basis of analysis of the impact of the Power Station on commercial species. Commercial species found in the Sizewell area are part of major North Sea stocks. The impact of the losses due to the Power Station is spread over these stocks, hence the effect is minimal. The mortality rate caused by the Power Station is one thousandth to one hundred-thousandth, depending on species, of that caused by commercial fishing and the effect is less than that of a small, inefficient commercial trawler.

5249 **(CONF-860742—2) Acoustic noise produced by corona discharges in A.C. power lines: loudness and annoyance.** Fiorina, M.; Rosa, F.; Piazza, R. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Jul 1986. 3p. NTIS (US Sales Only), PC A02. Order Number DE89770041/JAW.

From 12. international congress on acoustics; Toronto, Canada (24 Jul 1986).

In the framework of the 1000 kV system design project, systematic research on acoustic noise produced by corona on bundled conductors for UHV lines has been conducted. Moreover, experimental investigations on the physiological and psychological aspects of the noise produced by AC corona discharges have been done and are still in progress, as this type of noise is characterized by physical parameters that distinguish it from other types. The typical complex spectrum consisting of a few pure tones and continuous components extending up to ultrasonic frequencies, the stationarity and large variability with atmospheric conditions raise the question whether it would be legitimate to apply to the corona noise the same frequency weighting methods and criteria for a correct assessment of acceptable levels considered suitable for other more common noises: a direct knowledge of the loudness and annoyance charateristics of the corona noise is actually required. To

give a general view of the studies conducted in this fiels, tha paper reports a summary of loudness research already performed and the results of a first series of annoyance tests.

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 4326, 4327

5250 **(NAGRA-NTB—86-01) Exploratory borehole Weiach. Geology. Text volume.** Matter, A.; Peters, Tj.; Blaesi, H.R.; Meyer, J.; Ischi, H.; Meyer, Ch. (Bern Univ. (Switzerland); Geotest AG, Zollikofen (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Feb 1988. 468p. (In German). Nagra, CH-5401 Baden, Switzerland.

The Weiach borehole was sited in the geological transition zone between the Tafeljura and the Molasse Basin. The location chosen was some 900 m to the S of the River Rhine in the community of Weiach, Canton Zurich.Drilling was carried out between January 10th and November 12th, 1983. Coring was continuous throughout the 2482 m deep borehole with the exception of four intervals in the crystalline basement (these together totalling 160 m). Cores were oriented mechanically using a 'Multishot' device. The borehole penetrated a 2020 m thick sedimentary succession; coring permitted the first recovery of productive Carboniferous strata recorded from the Swiss Alpine foreland to date. The core samples were studied in detail using a variety of scientific techniques, with the main aims of characterising lithologies and reconstructing the geological history. 265 refs., 4 figs., 21 tabs.

5251 **(NAGRA-NTB—86-01) Exploratory borehole Weiach. Geology. Supplement volume.** Matter, A.; Peters, Tj.; Blaesi, H.R.; Meyer, J.; Ischi, H.; Meyer, Ch. (Bern Univ. (Switzerland); Geotest AG, Zollikofen (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Feb 1988. 110p. (In German). Nagra, CH-5401 Baden, Switzerland.

The Weiach borehole was sited in the geological transition zone between the Tafeljura and the Molasse Basin. The location chosen was some 900 m to the S of the River Rhine in the community of Weiach, Canton Zurich.Drilling was carried out between January 10th and November 12th, 1983. Coring was continuous throughout the 2482 m deep borehole with the exception of four intervals in the crystalline basement (these together totalling 160 m). Cores were oriented mechanically using a 'Multishot' device. The borehole penetrated a 2020 m thick sedimentary succession; coring permitted the first recovery of productive Carboniferous strata recorded from the Swiss Alpine foreland to date. The core samples were studied in detail using a variety of scientific techniques, with the main aims of characterising lithologies and reconstructing the geological history. 79 figs., 38 tabs.

5252 **(NAGRA-NTB—87-12) Work program. Borehole PPG-1 and seismical velocity profile.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Aug 1987. 47p. (In German). Nagra, CH-5401 Baden, Switzerland.

The topic of this report is to give the detailed work program of the foreseen drillings and to describe the investigations and measurements connected with it. It is based on the results of the advertisements and commission's negotiations as well as on the discussions with cantonal and communal authorities. The aim of the work is primarily the judgement of the geological and hydrogeological forecasts which have led to the choice of the area Piz Pian Grand as a potential site. 5 figs., 1 tab.

5253 (SEGJ—8801, pp 265-266) **On the correlation between electrical characteristics and physical properties of soils.** Watanabe, Naotaka; Shishido, Toshio; Fujita, Tatsushi; Furukawa, Yukio. (Nihon Univ., College of Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the correlation between electric characteristics and physical properties of soils. The natural soils for the samples were Koriyama clayey soils and Shirakawa loam. The standards were Kibushi clay, a product clay, and bentonite. The natural soils were differently dried to have different water contents, and were molded and compressed with a 1 ton load into a tightened cylindrical form with an inside diameter of 5 cm. The electric impedance of the moulding measured at 10 - 50 MHz, and the dielectric constant, the dielectric loss tangent, the conductivity, etc. were determined. The Shirakawa loam was different from ordinary soils and product clays in water content, porosity, etc. The conductivity and the dielectric loss tangent of the loam were low, though it had a relatively high water content. The loam when ground presented two times higher electric values than those of the unground loam, due to the bonding water. The porosity of the loam was significantly high, namely, 2 - 3 and higher. The porosity of the Koriyama clayey soil was lower than 1, and that of the product clay was higher than 1, respectively. Other clayey soils presented a porosity almost equal to the above values. Mountain sand was relatively low. As the sand content of the clayey soils and clay was higher, the dry density became higher. The loam, though it contained a relatively large amount of sand, presented a dry density below 1. (4 tabs, 3 refs)

5254 (SEGJ—8801, pp 276-279) **Rigididy of clayey soils and its physical properties.** Iwasaki, Yoshinori. (Osaka Soil Lab., Osaka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the rigidity of clayey soils at the sea floor of Osaka Bay and its physical properties by P,S well logging. The seismic S wave velocity was 38 m/sec. at the sea floor surface, and increased with the depth. The S wave velocity was relatively high in the sand - gravel strata, and was relatively low in the clayey stratum. The P wave well logging showed the same tendency in velocity as described above. The laboratory test on the correlation between porosity (th) and the calculation value of effective earth pressure (Pv) gave the following formula for the soils at the respective liquid limits: th = tho - Cc*log Pv where Cc is a compression index. the rigidity of the soils, based on the measured wave velocity was expressed by the following formula: th = tho - Cr*logG where Cr is a rigidity index. The following equations were derived from the correlation between LL, Cc, and Cr. Cc = 0.0027*(LL + 280), and Cr = -0.0027*(LL + 155). Conclusively, G can be expressed by a function of th containing LL as a parameter. In contrast to conventional empirical equations, there are no restrictions on th. Also, G can be formulated in relation to Pv, which is useful for wide application. (9 figs, 1 ref)

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 4142, 4214, 4813, 4814, 4829

5255 **(CONF-8612144—1) Integration of remote sensing data into an information system.** Della Ventura, A.; Rampini, A.; Rabagliati, R.; Rossi, G.; Serandrei Barbero, R. (Consiglio Nazionale delle Ricerche, Milan (Italy)). Feb 1987. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE89770071/JAW.

From 20. international symposium on remote sensing of environment; Nairobi, Kenya (4 Dec 1986).

Catchment management policy implies knowledge of expected inflow into reservoirs in order to determine optimal operating standards. For small reservoirs, such as those in the Alps, inflow is strongly affected by transitory phenomena such as floods or spring snowmelt. The need, therefore, arises for real time models to forecast inflow on a short-term basis. The Italian National Electricity Board (ENEL) has developed, for the management of its alpine reservoirs, a mathematical snowmelt model whose inputs are, above all, based on daily precipitation data, daily temperature values, and periodic snowpack depth and density measurements. This paper describes the experiment carried out by ENEL, in co-operation with CNR (Italian National Research Council), for the purpose of integrating the model information system with snowcover data obtained through remote sensing.

5256 **(EMR/GGG—8605) Geothermal program on the CCGS NAHIDIK cruises 1981-1983, Canadian Beaufort Sea.** (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Gravity, Geothermics and Geodynamics Div.). Mar 1986. 144p. (CE—01993). CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

This report describes work carried out on 1981-83 cruises in a large area of the Beaufort Shelf. Sediments were surveyed in parts of the Shelf and canyon areas under 30 m or more of water. Permafrost temperatures prevail in the sediments throughout the outer Shelf. The average sediment temperature at the water interface is ca -1.33/sup 0/C, a value that is somewhat higher along the paleotopographic channels and lower on the plains. Virtually all profiles exhibited a considerable thermal disturbance considered in most cases consistent with seasonal water temperature variations or, in some areas, arising from a particular geomorphic feature. Temperature gradients varied from negative to near zero; only one profile had a gradient similar to the expected geothermal gradient. Sediment temperatures were noted to increase along the channels in the offshore direction. Average thermal conductivity, ca 1.33 W/mK, was seen to be the same in mean value in both the Shelf and Mackenzie Canyon areas. Volumetric water contents calculated by time domain reflectometry (TDR) were within 20% of equivalent values determined through weighing and drying adjacent samples in the cores. There was poor correlation between these water contents and needle probe conductivities, suggesting that the TDR method is unreliable in saline sediments in practice. An evaluation of TDR-determined sediment electrical conductivity suggests that further refinement of the technique is required, as there was a lack of internal consistency in the data. However, geological reasonable values were obtained, ca 1.23 siemens/m at 20/sup 0/C 81 refs., 57 figs., 22 tabs.

5257 **(INIS-BR—1294) Dynamic of ground water in Tucano sedimentary basin.** Cabral, F.C.F.; Azevedo, A.E.G. de. (Bahia Univ., Salvador (Brazil). Inst. de Fisica). (Sociedade Brasileira de Geofisica, Rio de Janeiro). 1987. 1p. (In Portuguese). (CONF-8711243—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704777/JAW.

From 2. regional meeting on geophysics; Salvador, Brazil (25 Nov 1987).

5258 (INIS-mf—11328, pp 62) **Absolute dating of Austrian loess deposits.** Wild, E.; Wallner, G.; Hille, P.; Aref-Azar, H. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5259 **(JINR—R-11-87-816) On one multidimensional test for random number generators.** Ososkov, G.A.; Sandrikova, E.; Pshenin, E.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation; AN Kazakhskoj SSR, Alma-Ata. Inst. Fiziki Vysokikh Ehnergij). (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704396/JAW.

A multidimentional test for the uniform random number generator with the economical utilizing of computing resources is described. The test is based on a special partition of the multidimensional unit cube which preserves the number of partitioning cells and their volumes to be constant. The procedure realizes a fast computing of addresses of multidimentional histogram while filling it by random numbers and computes the statistical criteria of the uniformity of this filling. Results of testing different random number generators including those for microcomputers are given. 10 refs.; 1 fig.; 2 tabs.

5260 **(NAGRA-NTB—81-07) Exploratory boreholes Juchlistock-Grimsel.** Mueller, W.; Keusen, H.R. (Ingenieur-Unternehmung AG Bern (Switzerland); Geotest AG, Zollikofen (Switzerland)). (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Nov 1981. 102p. (In German). Nagra, CH-5401 Baden, Switzerland.

The aim of the investigation was the completion of missing geological, hydrogeological and rock-mechanical data about a suitable site for the intended Nagra rock laboratory at Grimsel. To this aim, 6 horizontal boreholes of 100 m length and 86 mm diameter were drilled. The cores, extracted practically without loss, and mechanical data for the main investigation was an extensive evaluation of the lithographic discontinuities and anisotropies, because they are the main determinant of the hydrogeological conditions of the locality. The area is dominated by granites and granodiorite which are of variable biotite content, lamprophyres and aplites. The largest part of the investigated mountain region consists of compact unclefted rock. 478 of the 600 bore meters, i.e. about 80 % of the drilled mountain, have no open clefts. Only 22 of the 600 bore meters (3.6 %0 contain more than five clefts per meter, at which the open clefts in the boreholes SB1 and SB5 appear more frequently. At the remaining exploratory boreholes in 90 % of the mountain ther are no open clefts. 15 refs., 52 figs., 15 tabs.

5261 **(NAGRA-NTB—88-27) Exploratory borehole Siblingen. Work program.** (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)). Aug 1988. 92p. (In German). Nagra, CH-5401 Baden, Switzerland.

Nagra is conducting a comprehensive geologic exploration program in northern Switzerland with the goal to provide the basic scientific information which is necessary to assess the suitability of subsurface formations for the safe storage of high-level radioactive wastes. The exploration program is composed of: a deep drilling and geophysical survey program to examine the regional subsurface geological and structural setting; a hydrogeological investigation program to delineate ground-water flow system(s) within the deep subsurface; and a neo-tectonic study program to examine recent tectonic activity and to identify zones where active earth movements may be occuring. With Siblingen (the seventh in the series of northern Swiss exploration boreholes), the objective is to obtain the relevant information for assessing the long-term storage characteristics of the crystalline basement and overlying Mesozoic sedimentary rocks within the region northwest of Schaffhausen. The work program for the Siblingen borehole contained in this report presents a detailed technical description of its design aspects, and describes the scientific objectives, the scope of investigations, test methods to be used, and the sequence of foreseen field and laboratory tests. The detailed work program has a dual purpose. Firstly it provides to participants involved, the general guidance and basis for all work activities performed within the borehole project. Secondly, it serves to inform government agencies, supervisory organizations, and the interested public of the planned work. 7 figs., 3 tabs.

5262 (SEGJ—8801, pp 261-264) **Electric property of water.** Okamoto, Keiichi; Tamaki, Itsuo. (Osaka Inst. of Tech., Osaka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Electric property of water was measured. The measuring apparatus used was an impedence analyzer. The samples were super refined-water, ion exchange water, tap-water and underground water. The dielectric constant and the conductivity were measured at 121 points of 10 Hz - 10 MHz in the logarithmic sweep mode. The dielectric constant at 1 kHz was 70 for the super reined-water, about 700 for the ion exchange water, and that of tap-water was 4×10^6 at 10 Hz. The dielectric constants and the conductivities of the tap-water and the underground water were almost equal. The dielectric constant of waste underground water had a difference by one order at low frequencies, depending on the survey pools, It is supposed that the tested underground water, when present in the earth, had a greater dielectric dispersion, due to the interfacial phenomena with the earth particles. Accordingly, the earth saturated

with the underground water with a dielectic constant of 10^4 order at 1 kHz exhibited a dielectric constant of 10^5 order at the same frequency. (10 figs, 4 refs)

5802 Geophysics

REFER ALSO TO CITATION(S) 4994, 5047, 5319

5263 **(EUR—11344) Catalogue of European earthquakes and an atlas of European seismic maps.** Van Gils, J.M. (comps.). (Commission of the European Communities, Luxembourg). 1988. 152p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88756007/JAW.

The Catalogue of European earthquakes and an atlas of European seismic maps has been prepared in the framework of the activities of the CEC Working Group on the safety of ligh-water reactors. Seismic hazards are considered to be an important element of possible external accidents to be taken into account in the design, construction, and operation of nuclear power plants. The report relies on the data base available, the historical as well as the present-day data. After a short historical review, actually-used intensity scales are discussed. The scale applied in European countries and the one proposed in the United States of America are compared. The different seismic maps of interest are explained and a mathematical procedure presented which allows, under certain conditions, to draw seismic maps by computer facilities.

5264 **(SEGJ—8801) Proceedings of the 78th SEGJ conference.** (Society of Exploration Geophysicists of Japan, Tokyo). 17 May 1988. 387p. (In Japanese). (CONF-8805220—). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW.

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The booklet contains 87 studies on research and development of exploration geophysics that were presented at the 78th conference of the Society of Exploration Geophysicists of Japan held in spring in 1988. These studies deal with, for example, radio telemetry seismic recording system, deep-towed seismic profiling system, all-directional S-wave generator, frequency characteristics calibration of geophon by impulse wave method, effects of cavity in rock mass on seismic waves, S-wave logging system by bimorph type source and receiver, PS logging by penetration detector, shear-wave splitting analysis in tri-axial downhole AE measurement, reflection logging in borehole, locking device for new velocity logging system, VSP probe for small diameter boreholes, BHTV logging, experiments and various analyses of seismic tomography, analysis program for seismic refraction method, application of generalized reciprocal method to seismic refraction interpretation, seismic reflection survey, ground and air vibrations, measurements and various analyses by vertical electrical sounding, evaluation of MT method.

5265 (SEGJ—8801, pp 1-3) **Transition zone seismic survey using a radio telemetry seismic recording system.** Onishi, Satoshi; Narahara, Shogo; Fujii, Mitsugu; Kumai, Motoi; Asada, Masaaki. (Japex Geoscience Inst., Inc., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A radio telemetry seismic recording system uses common radio frequencies for data transmission to perform sequential data transmission through separate channels. A water-proof measuremeing station (telemetry station unit, TSU) is installed at each receiving point. Each TSU records and stores data in response to radio instructions from the central control system. The TSU then sends the stored data by radio to the central control system after receiving specific instructions from the central control system. The transmission range is several km on land and 20-30 km on the sea. The time required for data transmission by a TSU is 823 ms for 3,000 point data. A shallow survey was carried out in 1987 using dynamite and a water gun as seismic source on land and sea, respectively, with a geophon and hydrophone as receiver on land and sea, respectively. These devices make it possible to make a survey continuously from the sea to land. (3 figs)

5266 (SEGJ—8801, pp 4-6) **Development of deep-towed seismic profiling system (Part 1).** Nishimura, Kiyokazu; Kishimoto, Kiyoyuki; Miyazaki, Teruki; Joshima, Masato; Murakami, Fumitoshi; Ishihara, Takemi. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

An off-line type deep-towed seismic profiling system is developed which consists of a deep-towed device, a positioning apparatus for the towed device and an onboard system for collection and processing of data sent from the towed device. A frame equipped with the towed device and a relay transponder is towed with a towing wire about 100m above the bottom of the sea. An air gun is towed astern near the surface to serve as sound source. The relay transponder acts as acoustic transponder for the towed device positioning apparatus and as receiver to receive acoustic instructions for the towed device sent from the ship. Reflected wave data received by a deep-sea hydrophone are digitized and stored in the towed device. After the completion of the measurement, the recorded data are transferred to equipment designed to store and process the data taken by the towed device. The equipment then produces profiles from the data. Experiments with the system are carried out at various points in the sea near Japan, including points of 8,300 m depth. Results show that the system operates satisfactorily to provide required survey data. (5 figs, 1 tab)

5267 (SEGJ—8801, pp 7-9) **Test of on-board local area network for research vessel.** Nishimura, Kiyokazu. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A second-generation network is constructed on Hakureimaru, a geological research vessel. The network consists of network controllers and twisted pair cables to serve as bus lines. A maximum of 32 network controllers can be connected and 128 terminals can be used. The transmission speed through the bus lines is 1 Mbps. The length of the bus lines is 1 km maximum and that of the cables between network controllers is 250 m maximum without using repeaters. The network performs transmission of navigation data, electronic mailing service, bulletin board service, data exchange between computers on the network, provision of data to minicomputers connected to the network for data processing, and common data file service. Tests of the on-board network are carried out using two network controllers. Different types of personal computers are used for the terminals. Results show that the network operates satisfactorily. (5 figs, 1 ref)

5268 (SEGJ—8801, pp 1013) **Internal structure of the accretionary prism inferred from synthetic acoustic impedance logs.** Nishimura, Eiichiro; Tokuyama, Eiichi; Sato, Jun; Saito, Masanori. (The Univ. of Tokyo, Ocean Research Inst., Tokyo, Japan; Kobe Univ., Kobe, Japan; Tokyo Inst. of Tech., Faculty of Science, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Synthetic acoustic impedance logs are used to analyze the internal structure of the accretionary prism in the south sea trough. Measurements are made along a traverse line (Line 6-1) ranging from off Muroto Point to the axis of the south sea trough and another line (Line 6-2) that is parallel to Line 6-1. Six-fold CDP stacking and deconvolution filtering with a filter length of 400 ms are carried out as preliminary processing of the logs in order to improve the S/N ratio without distorting the received waves. A strict method based on acoustic inversion is applied to the pre-processed seismic wave data. The trough filling along Line 6-1 has been slightly deformed due to folds and faults to start the formation of a prism. The investigation also suggests that trough filing has been rapidly deposited along Line 6-2 to cause changes in the acoustic properties of the lower layer. (9 figs, 4 refs)

5269 (SEGJ—8801, pp 14-19) **Dynamic binning and dip corrected NMO method for marine 3D seismic survey.** Onishi, Masazumi; Ota, Yoichi. (Japex Geoscience Inst., Inc., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The report presents a dynamic binning procedure and dip corrected NMO method developed for high-performance processing of data from a marine 3D seismic survey. In general, processing of data from a 3D seismic survey is performed by dividing the surveyed area (sea area) into rectangular sections (bins) and applying the NMO-stack processing procedure to each CMP (common mid point) gather, which is defined as the set of seismic traces contained in each bin. However, satisfactory stacking effects cannot be obtained when the NMO-stack processing procedure is applied to places characterized by reflection events with large gradients. A new method, named the dip corrected NMO method, is developed which performs NMO correction by shifting the reflection points to the center of each bin. Marine 3D data actually taken on the sea is processed by using the method. Results show that the continuity of reflection events is improved. (4 figs)

5270 (SEGJ—8801, pp 20-25) **Seismic vibrator control and the transmitting P wave.** Takahashi, Akihisa; Uede, Yoshio; Watanabe, Tsutomu; Yagi, Akira. (Japex Geoscience Inst., Inc., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A seismic vibrator generates vibrations in response to reference signals produced by an oscillator incorporated in the electronic control mechanism. In addition to a phase shift attributable to mechanics, a resonance frequency exists on the ground that depends on such factors as the Poison's ratio and weight of the baseplate, leading to a large phase shift near the resonance frequency. To prevent this, an accelerometer is mounted on the baseplate to control the frequency. Control of the vibromotive force, on the other hand, has generally been carried out in a way that maintains the reaction mass acceleration constant. Recently, however, questions have been posed about these control procedures. Field experiments made here reveal that the use of the ground mass or reaction mass as control signal serves to reduce the phase shift in the underground elastic waves to zero. However, results also suggest that the control of the baseplate is more effective to maintain the consistency with data taken by existing survey methods. (9 figs, 4 refs)

5271 (SEGJ—8801, pp 26-29) **All-directional S-wave generator.** Kasahara, Keichi; Oba, Tsunehiko; Hirai, Yukio; Kobayashi, Naota. (Nippon Geophysical Prospecting Co., Tokyo, Japan; Chuo Univ., Faculty of Science and Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

An all-directional S-wave generator is developed. Pulsed torque converted from inertial energy of a inertia wheel is applied to the ground to produce S-waves. A vertical-axis type inertia wheel and brake is installed on an exciting plate and a motor is used to rotate the inertia wheel. After reaching a sufficiently high speed, the wheel is stopped suddenly by the brake to produce a reaction force in the form of a large torque that is applied to the ground by means of the exciting plate, resulting in the formation of S-waves. The major features are that small or medium equipment can produce strong wave motion if the inertia wheel can be rotated rapidly, that the phase of S-waves can be reversed by rotate the inertia wheel in the reverse direction, that the system can be remote-controlled, and that S-wave can be generated in all directions to permit simultaneous measurement in various directions. Experiments show that a system with a moment of inertia of 3×10^6 c.g.s. can produce waves with similar profiles in all directions. It is also revealed that waves with undistorted profiles are transmitted over a distance of 50 m along a line in a direction. (4 figs)

5272 (SEGJ—8801, pp 30-34) **Overall frequency characteristics calibration of geophone by impulse wave method.** Gutierrez, J.; Kitsunezaki, Choro. (Akita Univ., Mining College, Akita, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Elastic impulse wave method was proposed as the characteristics calibration of high frequency region used for the seismic exploration. It was tested to expand this method from high frequency region to overall region by introducing a digital processing technique. A geophone is attached to a end of a rod, and the response of the geophone to which the elastic impulse wave is propagated through the rod, is recorded. The inputted particle velocity is calculated from the longitudinal strain of rod which is detected by strain gages attached to the rod. It is the prerequisite of this measurement that the response of the strain gages has high reliability up to high frequency region. The experiment was carried out with a test geophone of 28Hz resonant frequency and a acryl elastic rod of 22mm diameter x 1006mm length. It was found effective to determine the overall frequency characteristics for the geophone by eliminating the influence of succeeding multiple waves due to the data processing. (7 figs, 3 refs)

5273 (SEGJ—8801, pp 40-44) **Effects of a cavity in rock mass on seismic waves.** Sassa, Koichi; Ashida, Yuzuru; Murayama, Yasuhiko. (Kyoto Univ., Faculty of Engineering, Koyto, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A simulation with the computer program named Days 2 code was carried out for the seismic disturbance caused by a point impulse loading at the center of a model where there is a cavity in rock mass and the results were studied. Days 2 code is a simulation program used to analyze the dynamic transient stress caused by wave motion and the seismic disturbance. The study indicated that S wave was generated due to the exsistence of the hole. P wave amplitude and period changed with the cavity size and the distance from the source point. This time simulation agreed nearly with the result by Dresen and Ullrich. It was confirmed that the cavity place could be estimated from the changes of amplitude and period by conducting survey to the cavity direction and that this approach was effective for the cavity detection. (11 figs, 1 tab, 2 refs)

5274 (SEGJ—8801, pp 45-46) **Effects of low velocity zone consisting of multiple thin layers on a P-wave.** Watanabe, Toshiki; Sassa, Koichi; Ashida, Yuzuru; Kishimoto, Munemaru. (Kyoto Univ., Faculty of Engineering, Koyto, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A low velocity zone consisting of multiple thin layers that exists in base rock may have effects on the profile, amplitude and propagation velocity of a P-wave propagating through it. Model experiments are conducted to investigate such effects. Model calculations are made to interpret the experimental data. Results demonstrate the appropriateness of the calculation procedures. Then the effects of a low velocity zone on a P-wave is investigated based on model calculations. The experiments employ an aluminum rod (which represents the base rock) and a combination of alternating aluminum layers and acrylic resin layers (which represents the low velocity layer). The investigation shows that a P-wave which gets perpendicularly into a low velocity zone consisting of multiple thin layers will propagate through it in a profile represented by the superposition of an assumed wave propagating without reflection and multiple reflection waves in the layer. It is also shown that the wavelength of the incident P-wave has large effects on the profile, amplitude and propagation velocity of the transmitted waves. (8 figs)

5275 (SEGJ—8801, pp 50-55) **Laboratory study for estimation of permeability from full waveform sonic log.** Tezuka, Kazuhiko; Miyairi, Makoto. (Japan Petroleum Exploration Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Water immersion test was carried out with rock blocks to experimentally verify the relation between permeability of sandstone and Stoneley wave and to quantitatively determine the stratum(or rock) permeability from Stoneley wave. Waveform arrays were recorded by setting various trasmitter-reciever offsets over immersed sample rocks. Measured permeabilities were 100 to 6500 m darcy. Stoneley wave phase velocity had close correlation with permeability when lithology of samples was almost same, but when lithology of samples was different, this correlation was not effective. However, when new measure(Fp) was introduced, Fp showed a excellent correlation with permeability which was established throughout the samples whose lithology were rather different, where Fp is normalized difference between measured slowness(Sm) and calculated elastic slowness(Sc) assuming rock to be elastic, defined as follows: Fp=(Sm-Sc)/Sc. (6 figs, 11 refs)

5276 (SEGJ—8801, pp 56-58) **S-wave logging system by bimorph type source and receiver (Part 3).** Tokumaru, Tetsuyoshi; Sugiyama, Takeshi; Sakunaga, Sadao. (Chuo Kaihatsu Corp., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

An S-wave logging system incorporating a piezoelectric bimorph type source and receiver to be installed in a borehole is developed and tested. The report describes the new S-wave logging system and compares measurements made by it with field measurements by a conventional system. Measurements by the bimorph system show that the velocity increases with depth, though with some variation in velocity. The downhole method, on the other hand, has some difficulty in accurately determining the velocity distribution within a mirage layer since it is designed to determine the average velocity in each layer. For such a layer, therefore, measurement by the bimorph method is useful because the velocity distribution within a very small section can be determined accurately. In the new S-wave logging system, a source is provided only at the lowest part of the sonde. One source-receiver element is incorporated in each source-receiver device. Measurements are made for a sand layer and mudstone layer and the S-wave velocity is determined to be about 560 m/s from short and long received wave profiles. (8 figs, 2 photos, 1 ref)

5277 (SEGJ—8801, pp 67-71) **Example of reflection logging.** Sakai, Kishio; Kai, Kuniomi; Misawa, Seijiro. (Chishitsu Keisoku Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A method of measuring the depth of a pile was developed. A borehole is provided near an objective pile. Shock waves are generated in the borehole, followed by detecting the reflection waves against the pile side and estimating the presence of the pile. For the measuring probe, a magnetic floating hammer for generating shock waves, a pick-up for trigger, and a pick-up group for receiving are accommodated in a polyvinylchloride cylinder. The depth of an existing pile provided in an alluvial sand stratum was estimated by this method. A hole for measurement was bored through the alluvium and then into the dilivium. The bore depth was 35 m. The measurement was conducted in the depth range of 35 m - 5 m, every 1 m interval by using the probe enclosed with an iron case. Two wave groups were detected simultaneously at about 5 msec after generation of the shock waves respectively. No wave groups later received as described above were detected when the measurement depth was 24 m or more. It was estimated that the pile depth was 24 m - 25 m. (5 figs)

5278 (SEGJ—8801, pp 77-81) **Development of VSP probe for small diameter boreholes.** Inazaki, Tomio; Watanabe, Fumio; Suzuki, Fumio; Kawamura, Shigeki; Hoshino, Tatsuya. (Public Works Research Inst., Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

For full wave prospecting with elastic waves, a well logging probe for small diameter boreholes was produced as a trial. Three seismographic elements are arranged 120 degree interval to the horizontal direction, and each element in inclined 54 degree to the vertical direction (54 degree system). The seismographs which are produced according to the same specification and have the same vibration characteristics. The fixing state of the probes and the attaching state of the seismographs to borehole ground can be easily confirmed by generating vibrations in the vertical direction with the inner shockers mounted in the probe interiors, and monitoring the vibrations. The probes are attached to the wall of a borehole by piston system, so that the attachment is secure without troubles in field test. The probe system is used for one-site vibration measurement. By connecting two probe systems for field test, seismic recording with the same seismic source can be obtained at two sites, and the measurement of Q value by using waves directly is possible. (7 figs, 1 tab, 2 refs)

5279 (SEGJ—8801, pp 88-91) **Experimental studies on seismic tomography.** Ishii, Yoshinori; Kato, Yoshibumi; Rokugawa, Shuichi; Kawahara, Hiroshi. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Tube waves which are a hindrance to geotmography using a well, was examined by using a two-dimensional model and boundary waves of Rayleigh type. For the two-dimensional model, a polycarbonate plate with 1 m x 1 m x 1 cm (thickness) which corresponded to a real well was used. A seismic source was fixed to the side end of the model plate 25 cm above the lower end. Receivers were attached to the same side end at 2 cm interval. In the experiment, the phenomena where the boundary wave was converted to a P wave, and inversely the P wave to a boundary wave. It has been revealed that the wall face as the two-dimensional model, though it is essentially different from a real well, serves for an immediate understanding of the tube wave tomographic problems, which have not been investigated. The simple two-dimensional model is effective in treating such interference waves which will be more important problems to be solved. (7 figs)

5280 (SEGJ—8801, pp 92-93) **Improvement of the accuracy of seismic tomography by an effective ray-tracing.** Sassa, Koichi; Ashida, Yuzuru; Kozawa, Takeshi; Yamada, Masayuki. (Kyoto Univ., Faculty of Engineering, Kyoto, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The improvement of the accuracy of seismic tomography by an effective ray-tracing was investigated. A wave path from focus to receiving point was calculated accordingthefollowing steps. Based on Huygens's principle, a point where elastic wave reached becomes secondary wave source point, and the wave motions extend to direction of sixteen. Modified wave path is determined by application of Fermat's principle and refraction removal procedure in same medium. By modified wave path, each wave's crossing length in cell and travel time are calculated, then invers of velocity of each cell is calculated by least square iteration method. A structure model which has a cell with 340 m/s in the medium with elastic wave velocity of 3000 m/s was applied to the calculation. The CPU time required for the calculation was 3.00 sec in iteration times of four. Existence of low velocity zone was detected accurately by the modification of the wave. The ray-tracing method can be applied effectively to the seismic tomography in the aspects of the accuracy and the CPU time. (6 figs)

5281 (SEGJ—8801, pp 94-97) **On the characteristics of diffraction geotomography by Fourier transform.** Ishii, Yoshinori; Rokugawa, Shuichi; Sato, Mikimoto. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The characteristics of diffraction geotomography by Fourier transform were investigated. Existence of velocity abnormality C(X,Y) in the homogeneous medium at X-Y coordinate system is presumed. A plane wave which has direction vector with angle of theta zero to X-axis is discharged to the velocity abnormality C, and that scattering field is observed on the base axis of extension of incident direction. The measurement is carried out changing theta zero in turn, the projected data are plotted on the frequency domain, then the image of C(X,Y) is regenerated using two-dimensional direct Fourier transform method. A model with low velocity abnormality of 2700 m/sec was assumed in the center of medium with velocity of 3000 m/sec and side length of 200 m (depth of 200 m). The frequency component with range of 30 Hz to 180 Hz was divided into six components at imtervals of 30 Hz, then the input waves of six components were simulated. Four direction incidence was superior to two direction incidence. The depth direction resolution was further improved by including of data on surface-dry holes obtained by incidence angle of 45°. Increase of the number of projections and extension of the frequency zone were effective for improvement of accuracy. (9 figs, 3 refs)

5282 (SEGJ—8801, pp 98-100) **Problems of ART methods in seismic tomography.** Rokukawa, Shuichi; Ishii, Yoshinori; Igaki, Kazuaki. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Problems of argebraic reconstruction technique (ART) in seismic tomography were reported. A model with granite high velocity abnormality (F) in center with propagation velocity of 3.40 Km/s was used, and it was also surrounded by low velocity gypsum (S) of 1.60 Km/s. A shortest time path between focus and receiver was selected for tracing of the refracted raypath. Initial travel times by refracted raypath and wave equation model showed similar behaviors. Initial travel time by straight raypath, however, showed remarkable difference at the portion near by upper part of F and at the portion where focus and receiver were put in counter position across the velocity abnormality. In observed data, the travel time of raypath crossed F was lesser. ART by use of refracted raypath was superior to that of straight raypath in detection of F. It is considered that heterogeneity of the raypath are based on the geometric constraints of focus and receiving point and the properties of propagation model. Attention is required in existence of s. Reliability of the velocity distribution is affected by the density or the distribution of raypath. (3 figs)

5283 (SEGJ—8801, pp 101-106) **Development of an interactive analysis program for seismic refraction method.** Katayama, Koji; Yokoya, Naomichi. (Oyo Corp., Saitama, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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An interactive analysis program for seismic refraction method was developed. Features include: (1) complicated and routine works are analyzed by use of computor; and (2) judging works are made the most of analyzer'judgement using advanced graphic function. Corrections of the travel time curve and so on are indicated on the scope by the tablet. Maximum traverse line length is 1000 m in receiving point interval of 5 m and is 2000 m in that of 10 m. Maximum number of shot-points is twenty five and number of layers is six. The travel time curve, depth travel time and the analytic cross section are output to the electrostatic plotter. Results of the manual analysis and the program analysis by a different person were compared on the data obtained from the site. Both of them had four layers structures with a little differences of propagation and the low velocity zones were detected around the receiving point of 180 m, the results were fairly similar. The works were carried out flexibly due to direct indication by the tablet, the corrections were simple and quick, the load of analyzer was lightened, and the working time was shortened. (7 figs, 2 tabs)

5284 (SEGJ—8801, pp 107-109) **Application of the generalized reciprocal method to seismic refraction interpretation.** Omi, Michito; Kaneko, Katsuhiko; Nishida, Kazuhiko. (Kumamoto Univ., Faculty of Engineering, Kumamoto, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Application of the generalized reciprocal method (GRM) to seismic refraction interpretation was investigated. On the assumption that a wave from focus A on the ground surface reachs to the ground surface Y passing through lower layer (second layer), a wave from focus B reachs to the ground surface X in the same way. By suitable selection of the distance XY, head waves from same point on the refracting face reach to X and Y (optimum XY). In the GRM, distance XY is variable and corresponding velocity travel-time curve is drawn. In determination of optimum XY, there are tow different methods: (1) direct calculation method; and (2) observation method. The interpretation was carried out using the stratum model with first layer velocity of 400 m/s and second layer velocity of 1200 m/s. In the simple stratum model such as horizontal two layers and inclined two layers, the optimum XY as the distance between receiving points which relate to round trip traveltime from same boundary layer couldn't be determined. The reason was that the velocity travel-time curve was consistent with straight line with gradient of inverse of second layer velocity. If there are undulations and/or differences in level on the boundary layer, the results obtained by the study could be fairly similar with real configuration of the boundary layer. The GRM appears to be applicable under the limited conditions of undergroud structures. (5 figs, 2 refs)

5285 (SEGJ—8801, pp 110-113) **Seismic reflection in the west of Kumagaya, Saitama prefecture.** Inazaki, Tomio; Jinbo, Satoru; Nagasawa, Masakazu; Abe, Masahiko; Ikeda, Ken'ichi; Sugimoto, Yoshihiro. (Public Works Research Inst., Ibaraki, Japan; Dia Consultants Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The seismic reflection survey was made to some extensions of the Fukaya Fault, the west of Kumagaya, to detect a buried active fault in a plain. Two survey lines, that is, AL(1.3km) and AR(1.5km) were set up on both banks of the River Arakawa near the Arakawa Bridge. AL profile comprises two major layers bounded by unconformity and the lower layer is dipping homoclinally to the east. AR profile is slightly dipping to the east. Both upper layers contain a continuous and strong reflecting plane respectively. The unconformity is about 80m deep and upper reflecting plane is about 30m deep. AR profile contains some faults and the two separate upper and lower layers, forming a reverse fault of rising west as a set. But the displacements are smaller and 20m length at the depth of 150m and 10m length near the surface. AL has no faults to displace the surface. About 5m displacements dipping eastward were found at 42.5km from Omiya and near the south side of the Kumagaya Bridge. (4 figs, 1 tabs)

5286 (SEGJ—8801, pp 114-119) **Engineering geophysical surveys on a mountain roadway.** Inazaki, Tomio; Jimbo, Satoru. (Public Works Research Inst., Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Geophysical surveys were carried out to investigate the geological structure at the predetermined spot for snow sheds construction on national route 41. The velocity distribution by surface vibration method didn't show velocity contrast which determine the boundary between the bedrock and the banking, and was not consistent with the boring data, either. So it was difficult to estimate the depth-to-bedrock. The results of georadar method were

consistent with the boring data on the roadbed and distribution of the bedrock line. About the bedrock, however, there were not enough reflection signals to ascertain it directly. The profile through seismic refraction method wasn't consistent with the geological structure ascertained by borings and other methods. In gravity method, depth structure was estimated with corrected vertical gravity gradient: difference between observed gravity each at road surface and at 1 m above road. The results were in correspondence with the boring data. By combined application of the boring surveys, the micro-geography surveys, and the gravity method, it was concluded that the layer of velocity of 3.5 Km/s was suitable as the basement of the snow sheds. The gravity method was confirmed to be available, showing undulations of basement clearly, and to be complementary to boring surveys with economy and simplicity. (9 figs, 1 tab)

5287 (SEGJ—8801, pp 120-123) **Case study on shallow seismic reflection and VSP methods in soft soil ground.** Otomo, Hideo; Wakuno, Masato; Ota, Kenji; Takahashi, Toru. (Oyo Corp., Saitama, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A case study on shallow seismic reflection and VSP methods in soft soil ground was discussed in this report. The seismic reflection prospecting was carried out on bedrock distribution under alluvium, which sometimes brings a trouble in laying of sewerage pipe. VSP was carried out by boring a hole of 20 m depth under the traverse line with each measuring depth space of 1 m. At the boring point, the bedrock was below the depth of 20 m. However, some waves were estimated to be the reflected waves each from the deep bedrock surface and the conglomeratic soil according to the wave forms and the composite reflected wave forms obtained through VSP. From the results above and those of the boring surveys, it was found that the depth-to-bedrock changed widely from GL -5 m to -45 m and the point where the bedrock had been ascertained through the boring survey was applicable to the ridge of bedrock. Through the seismic reflection survey, a ridge reached to the formation level was found. The depth of the ridge was reascertained, and the result was consistent with the seismic prospecting datum. If there is great undulations, determination of bedrock distribution is difficult by boring survey alone. The boring survey is effectively used with the shalllow seismic reflection method, and much more effectiveness can be expected with VSP. (3 figs)

5288 (SEGJ—8801, pp 124-127) **Waves generated by a vibrator and geophysical prospecting.** Kawaharada, Hiroshi; Takaya, Tadashi; Kojima, Masakazu; Yora, Hiroo; Imasato, Takehiko; Hattori, Sadaiku. (Nihon Chika Tansa Co., Ltd., Chiba, Japan; Building Research Inst., Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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An investigation on waves generated by a vibrator and geophysical prospecting was conducted. Borings were carried out at point A with depth of 20 m and at point B with that of 7 m, PS well logging and observation of the waves were performed. A distance between A and B was 2 m. Nine kinds of waves with different frequency in the range of 3 to 50 Hz were generated in order by a vibrator which installed at a distance of 2 m from A in the opposite direction to B, then the waves were measured by velocity-type seismometers with natural frequency of 1 Hz located at surface and underground of A and B respectively. The subject spot of investigation on the particle orbits was point A. The phase velocity distribution curve obtained by the measurements was well consistent with the theoretical dispersion curve of the basic mode calculated under the velocity structure model. The shape of the particle orbits indicated the characteristic of the surface wave in the case of 10 Hz or more. About the amplitude distribution in underground, the observation values were consistent with the theoretical values in the case of 10 Hz or more. It was concluded that the waves with frequency of 10 Hz or more are Rayleigh wave. It was also found that average S-wave velocity in a wave length region is approximately similar to the S-wave velocity in the depth of 1/2 wave length. (6 figs, 1 tab, 5 refs)

5289 (SEGJ—8801, pp 184-185) **Immediate earthquake damage estimation and emergency response information system. For preventing social resources from disasters.** Goto, Noritoshi; Ota, Yutaka; Ishihara, Kyo. (Muroran Inst. of Tech., Hokkaido, Japan; Hokkaido Univ., Faculty of Engineering, Sapporo, Japan; Mark Rand Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The immediate earthquake damage estimation and emergency response information system intended for local government are discussed in this report. This system was developed to estimate the damage of social resources immediately and to reduce the damage to a minimum. The resouces include not only underground minerals but also buildings, human beings, and urban facilities. Earthquake damage is estimated from observation data by a one-spot three components accelerometer, regional environmental informations, and empirical formula of disaters. A guide to measures for the regions are indicated to support their efficient operations. Hypocentral distance and seismic intensity are calculated. Then regional seismic intensity distribution is determined from regional ground distribution using increment of seismic intensity of each ground. Earthquake damages are estimated from the regional average seismic intensity. Numbers of buildings which divided into two kinds of timber type and non-timber type are determined according to the extent of damage, and numbers of the outbreak of fire and the spread of fire are estimated. Numbers of deaths and injured persons are also calculated. Damages and its effects on gas service, water supply, electric service, traffic system, and communication system are estimated. Proper measures on establishment of headquarter, personnel mobilization, rescue, fire fighting, refuge, and water supply are selected and displayed on the screen. (6 figs)

5290 (SEGJ—8801, pp 187-188) **Measuring method of variably apparent resistivities by rains at the ground surface.** Inoue, Makoto. (Dia Consultants Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Changes in resistivity at the ground surface are measured. A pair of electrodes are installed 20 cm apart at depths of 20-60 cm in the Kanto loam layer to determine the dryness of the surface soil, infiltration of rainwater and movement of surface water in the ground. Weather has large effects on the apparent resistivity measured at each measuring point. Rain decreases the resistivity while sunlight increases it. During the thawing season, the resistivity decreases at a depth of 20 cm at noon and at depths of 20 and 40 cm at 3:00 P.M. When 500 cc of 20% salt solution is poured in holes (20 or 30 cm deep), the resistivity immediately shows large changes and becomes stable in six hours. During the subsequent period, it undergoes slight changes each time it rains. These results reveal that the method can roughly determine the water content in soil and movement of surface water at an apparent position and depth. (4 figs, 4 refs)

5291 (SEGJ—8801, pp 189-190) **Automatic measuring system of electrical prospecting.** Kamata, Fumio; Kai, Kuniomi; Misawa, Seijiro. (Chishitsu Keisoku Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Electrical resistivity prospecting requires a large amount of labor, time and cost. A study is made to develop an automatic measuring system which is labor-saving, reliable and able to quickly obtain a large volume of data that can be processed by a computer. The main functions of the electrode switching device include electrode arrangement selection, individual electrode position selection, measurement and recording, while the secondary functions include illumination (which displays the operating conditions), malfunction detection/automatic shutoff and alarm. The switching of the main functions is controlled by a robot. The measuring system consists of a DC-AC converter operating on a 12 V battery, digital pressure gauge, digital ammeter, printer for monitor, output terminals and

connecting terminals. The robot for electrode switching operates solely according to instructions from the computer. Data taken, coupled with the altitude of each electrode installation point, are put into the computer for processing to provide a five-color section diagram showing apparent resistivity distribution. (12 figs)

5292 (SEGJ—8801, pp 191-192) **Vertical electrical soundings at a northern part of the Joso terrace.** Ayuzawa, Hidemi; Murakami, Yutaka; Muraoka, Atsushi; Ono, Yoshihiko. (Sogo Geophysical Exploration Co., Ltd., Tokyo, Japan; Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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The report describes vertical electrical sounding performed in a northern part of the Joso terrace. The sounding was carried out with a recently introduced electrical sounding system (SYSCAL-R2) as part of the testing of its performance for deep sounding. The system can measure three quantities: resistivity, SP and IP (charging rate). The measuring sensitivity is 0.1 mV above 8 mV and 0.01 mV below 8 mV. Its current profile is of the alternate direct current type (rectangular wave) with quiescent intervals during which IP measurements are made. The Schlumberger method is used to conduct vertical sounding along a line crossing the Joso terrace in the east-west direction. There exists a layer with a low resistivity increases toward the west until it becomes stable at 50 ohm-m. This is consistent with results of shallow reflection sounding. The layer contains an abnormal point with an SP measurement of 30 mV. The investigation shows that the system can perform vertical sounding satisfactorily up to AB/2=1 km normally and AB/2=2 km under favorable conditions. (5 figs, 4 refs)

5293 (SEGJ—8801, pp 193-194) **Case study of rho(a)-rho(u) prospecting method. In the case of cavities under pavement.** Kashiwai, Yoshio; Nakai, Takumi; Kinoshita, Akira; Nakatsuka, Yasumasa. (Inst. for Geophysical Exploration, Kyoto, Japan; Ono City, Section of Sewerage Construction, Hyogo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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This paper describes the applications of rho(a)-rho(u) prospecting method to detection of cavities under pavement. In the survey section, the sewer was provided by 1.2 m diameter propulsion method in 1982. As the ground surrounding the sewer has become loosed, there are possibilities of generating of cavities, sinking and depressing of the road face. The ground was examined in 1987, namely, 5 years after the execution. With respect to two measurement lines, the resistivity of the ground was automatically measured at an electrode distance of 1.0 m by rho(a)-rho(u) method. As compared with generally expected resistivity distributions, this resistivity distribution presented a high resistivity portion, which suggested the possibility of a cavity having a higher void ratio than natural ground. The cavity was confirmed by boring and drilling with a heavy duty machine, which highly corresponded to the survey results. As revealed, this method is effective in detecting cavities under pavement. (5 figs)

5294 (SEGJ—8801, pp 195-196) **Mise-a-la-masse measurements about a resistive anomalous body.** Ban, Hideaki; Mizunaga, Hideki; Ushijima, Keisuke. (Teikoku Oil Co., Ltd., Tokyo, Japan; Kyushu Univ., Faculty of Engineering, Fukuoka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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The survey of high resistive anomoulous bodies were examined. For natural resource exploitation, underground survey, and so on, it is important to detect underground cavities and fractures which are high resistive anomoulous bodies. In case that a survey object is positioned near the well into which a steel casing is inserted, the object can be detected by flowing current through the steel casing pipe, and measuring the distortion in potential distribution which is caused by the difference between the resistivities of the object and the medium surrounding the object. For this purpose, it is necessary that the contrast of an object to the medium in resistivity is high. The data is analyzed based on the difference between the apparent resistivities and the distortion in electric field. An apparent resistivity anomaly caused by a high resistive body with a resistive contrast of 100 was calculated. In the case of a mineral body, the boundary of a positive and negative anomalies were exhibited near the mineral body. Based on both of the anomaly distributions, the direction and distribution region of the mineral body could be estimated. Though low resistive bodies exhibit strong anomalies, this method can be applied to high resistive bodies so long as the contrast is high. The distortion distribution of electric field is more directly useful for detection of anomalous bodies than the difference between the apparent resistivities. (2 figs)

5295 (SEGJ—8801, pp 197-200) **Airborne VLF survey of Izu-Oshima volcano.** Murakami, Yutaka; Yukutake, Takeshi. (Geological Survey of Japan, Ibaraki, Japan; The Univ. of Tokyo, Earthquake Research Inst., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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Resistivity distribution in underground indicates anomaly in some cases due to volcanic activity, airborne VLF survey of Izu-Oshima volcano in whole area was carried out by measurement of the anomalous vertical magnetic field. The flight direction was determined with reference to both of the transmitter direction of the VLF waves and the running direction of the geologic formation. The flight altitude and the flight lines spacing were 100 m and 200 m respectively. Typical profiles of four lines of measurement were investigated. The resistivity anomalies were indicated corresponding to the position of known geologic fissure line, the lip of the caldera, the line of the craters and side volcanos. Several anomalous trends were detected by the contour drawing of the Fraser filter output. The detected results were as follow: new volcanos with the resistivity anomaly, the resistivity anomalies spread to the north-northwest from Goshinka jaya, the anomalies due to flowed lava, the anomalies by encroached water from the caldera wall, the effects from side volcanoes and so on. The resistivity anomalies by airborne VLF survey correspond to the known volcanic activities, and they are useful for elucidation of the underground volcanism. (6 figs, 4 refs)

5296 (SEGJ—8801, pp 201-206) **Evaluation of CSAMT method in Izu-Oshima volcano.** Takakura, Shin'ichi; Ogawa, Yasuo; Murakami, Yutaka. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

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This paper describes the evaluation of CSAMT method in the Izu-Ohshima volcano. By the CSAMT method, which utilizes artificial signals, the intensity and frequency of signals can be optionally selected, and the survey accuracy is high. However, if the signal source is excessively near a field, the 'near field' problem is caused. In the case of a model that a surface layer with a resistivity of 1000 ohm m and a low resistive layer with a resistivity of 10 ohm m at 500 m in depth exist, the distance between the signal source and the field should be at least 3 - 4 km when the used frequency is 4 - 2048 Hz. The survey in Izu-Oshima was conducted as a distance between the transmission location and the measurement point of 3.5 - 7 km and a frequency of 1 - 2-48 Hz. No 'near field' problems were found, and the signal intensity and reproducibility were satisfactory. At a deep position, low resistivity anomalies could be detected. A low resistive layer with 500 or 600 - 5000 or 6000 ohm m in the geologic surface layer, and that below 50 or 60 ohm m near the sear surface were found. This agreed with the results by Shulenberger method excepting for the significant low resistivity at the surface layer. CSAMT method is effective in geological survey in volcanic regions with low resistive anomalies, i.e., geothermal hot water, magma, etc. (8 figs, 2 refs)

5297 (SEGJ—8801, pp 207-211) **On the near field effect in the CSAMT method.** Shiga, Nobuhiko; Saito, Akira. (Mitsui Mineral Development Engineering Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The near-field effect caused by CSAMT survey was examined. For the transmission source, current is made to flow between a pair of electrodes at a distance (L). Assuming that a survey site is on the perpendicular bisector of the transmission source, the electric and magnetic fields at the site were numerically calculated. As the distance between the transmitter and the receiver is shorter, the resistive amplitudes for the electric, magnetic fields are more deviated from those by the dipole transmission source. However, the near-field effect due to the distance (L) exerts a greater influence on the apparent resistivity than the distance (r). For homogeneous earth, it is necessary to set the transmitter-to-receiver distance (r) at a value 4 times longer than the surface depth (d). For the double layer earth, when the r/d ratio is high, the apparent resistivity is equal to that by MT method. When the r/d ratio is below 20, the near-field effect is caused. The near zone where the primary electromagnetic field is prominent almost excludes geostructural informations. The data correction brings useful informations. For the intermediate zone, data correction is possible. It is preferred to exclude the near zone by increasing (L), (r). However, this causes an unduly high (r). (4 figs, 5 refs)

5298 (SEGJ—8801, pp 212-217) **Geoelectrical structure in Kan'nabe volcano by CSMT method.** Nishimura, Susumu; Katsura, Ikuo; Arsadi, E. M.; Ito, Hisatoshi; Yamada, Yoshihisa; Mogi, Tooru; Nakama, Kazuhide; Kajiwara, Tatsuya. (Kyoto Univ., Faculty of Science, Kyoto, Japan; Kyushu Univ., Faculty of Engineering, Fukuoka, Japan; Otani Univ., Kyoto, Japan; Central Research Inst .of Electric Power Industry, Tokyo, Japan; Construction Project Consultant Co., Ltd., Osaka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The resistive structure of Kannabe Volcano (at present, not active) was surveyed by the CSMT method where two transmission stations were used with a used frequency of 7.8 - 5120 Hz. The pseudosections surveyed by the first transmission station revealed that lava flows or scoria layers, volcanic conduits were filled with rock fragments, and showed geostructural weak lines. The second transmission station detected that the volcanic conduits were arranged along the geostructual weak lines in the northwest - southeast direction. In addition, geostructural weak lines in the north - south direction were detected, and it was possible that volcanic conduits would exist on the cross points. After 'near field' correction, one dimensional layer structure analysis was conducted. The conclusions are as follows: The CSMT method is suitable for survey of volcanic structures. The volcanic conduits in Kannabe volcanics are arranged along the geological weak lines, or exist on their cross points. The volcanic conduits are filled with rock fragments. The temperature is still high at a deep position. The results by the CSMT method agree to those by MT survey and resistivity method. There is no low resistive layer at a deep position. The temperature at a lower position is low as compared with Kuju, etc. (4 figs, 5 refs)

5299 (SEGJ—8801, pp 218-222) **Mechanism of static effect and its removal in magnetotellurics.** Sasaki, Yutaka. (Kyushu Univ., Faculty of Engineering, Fukuoka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the mechanism of static effect observed in MT exploration, and their removal. A structure heterogeneous in resistivity, if exists near the measurement sites at near-groundsurface, causes SE effects. This is a hindrance to the analysis of MT data. The relation between MT data at ground-surface and the two-dimensional resistivity distribution of the vertical section of the earth below the ground-surface divided into many unit blocks. The profile of apparent resistivity measured with electrodes positioned at an interval on the measurement line is assumed to stand for the total output of spatial filter group for which the input series is the resistivity of the block in the horizontal direction. The filter group exhibits a high-pass characteristic for the input of resistivity near the electrodes. In this case, as the frequency of electromagnetic waves in the geologic structure is higher, its contribution to the apparent resistivity is larger, and exceeds the contribution by the deep structures. This results in SE problems. The geologic structures except ones near the electrodes exhibit a low-pass characteristics. The SE effect is more inhibited as the distance between the electrodes is longer. However, the high frequency component tends to be lost from the profile of apparent resistivity. The array system of electrodes in which the electrode interval is short to measure the potential gradient closely, and the related filter processing can remove the SE effects and reduce the cut-off degree of the high frequency component. (5 figs, 5 refs)

5300 (SEGJ—8801, pp 223-224) **Topographic effect in magnetotellurics. Approximation by rectangular elements and effect of bipole length.** Sasaki, Yutaka. (Kyushu Univ., Faculty of Engineering, Fukuoka, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on topographic effect in MT, particularly, on topographic approximation by rectangular elements and the contribution of pibpole (a pair of electrodes) length to the topographic effect. The approximation of an undulating profile to a step-form by rectangular elements does not give satisfactory MT results. This is because the electric field component along the step-form profile is discontinuous, though the magnetic field component perpendicular to the topographic cross-section is continuous. The equimagnetic field lines near the step take a step-like flux. On the other hand, the equimagnetic field lines sufficiently distant to the step-form profile are coincident with those in the real undulating topology. As to the electric field which is represented by the spatial primary differential form of a magnetic field, calculation of the electric field sufficiently distant to the step profile gives almost the same results as would be obtained by calculating the real electric field. High accuracy apparent resistivities can be obtained by utilizing the possible smallest rectangular elements and an electric field positioned below the measurement electric field. For MT measurement with a bipole, the measured electric field is an average value. Accordingly, it is necessary to select an appropriate electrode interval for modeling true of the real topology. By using the altitude data, the electric field measurements with the bipole are averaged with much difficulty. From the practical viewpoint, it is preferred to approximate the real undulating topologic profile to a smooth one and calculate an MT response at the center between the electrodes. (3 figs, 4 refs)

5301 (SEGJ—8801, pp 225-230) **Development of a highly efficient portable MT (magneto-telluric) system (Part 2).** Muramatsu, Shigeki; Takasugi, Shinji; Yamaki, Hiroyuki; Ikehata, Tatsukuni. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan; Meisei Electric Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Based on the 5 years project "Development of a highly efficient portable MT system" started in 1984, "Portable four MT station recorders and triple remote reference processing MT system" developed in 1987 was reported. Data processing and storage functions were enhanced whereby observation stations were increased from two stations in the previous year to four ones and it became possible to observe simultaneously at four stations. Data processing frequency domain was expanded by the introduction of a super high frequency MT (SHFMT) method whereby more precise analysis was made possible over a wider range of depth than that of the previous method. The field test including 59 conventional MT and 212 SHFMT sounding stations was carried out in the same area as before in Oita and Kumamoto Prefecture, and the long distance remote reference MT method was confirmed to be effective in removal of noises in the area. (6 figs, 3 tabs, 1 ref)

5302 (SEGJ—8801, pp 231-236) **Case study of a highly efficient portable MT survey in Kyushu (Part 2).** Muramatsu, Shigeki; Takasugi, Shinji; Kawakami, Noriaki; Naito, Junji; Miura, Yasuo. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Based on the 5 years project "Development of a highly efficient portable MT system" started in 1984, the field test over a month in Kumamoto Prefecture in Sept., 1987 was reported. The test was carried out to confirm whether ?Realtime for MT station recorders and triple remote reference processing MT system? operated normally, and no problems found out over all steps of the process from data acquisition to analysis. Acquired data in the test and resistivity well logging data were compared and confirmed to be well coincident. Using new data of super high frequency domain or super low frequency domain, shallow resistivity structures were clarified in detail, and also gathering MT data along survey traverses, small scale resistivity structures not detected by conventional MT sounding arrangement came to be capable of detecting. Consequently, this method was suggested to be applicable to not only a rough survey but also a detailed survey. (11 figs)

5303 (SEGJ—8801, pp 237-242) **Two-dimentional interpretation of a highly efficient portable MT data.** Muramatsu, Shigeki; Takasugi, Shinji; Kawakami, Noriaki; Naito, Junji; Miura, Yasuo. (Gerd Geothermal Energy Research and Development Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Based on the 5 years project "Development of a highly efficient portable MT system" started in 1984, the results of data analysis by one- and two-dimentional modeling programs developed up to 1987 were reported. The field test including 6 conventional MT and 40 SHFMT (super high frequency MT) sounding stations was carried out in Ibaraki Prefecture. In the two-dimentional modeling, it was tried not only to confirm a curve matching between calculated MT parameters and observed data, but also to grasp errors quantitatively by the mapping of apparent resistivity residues for the purpose of correction of underground resistivity models. In the testing area presenting two-dimentional underground resistivity structures, the one-dimentional modeling with TE mode was well efficient, while data analysis by SHFMT method was useful for shallow resistivity structures. (11 figs, 4 refs)

5304 (SEGJ—8801, pp 305-309) **Case study of RAMAC system in Toki granite.** Sakuma, Hideki; Tsubora, Koji; Olsson, O.; Lundmark, L. (Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan; Swedish Geological Co., Stockholm, Sweden). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Borehole radar measurements(reflection and transmission processes) were carried out at two granite sites in Japan using RAMAC system. It was found from these measurements that the rockmass in the site was separated at 300m depth and upper zone was a low resistant rockmas with much fissures and lower zone was a sturdy rockmass. This result was consistent with other surveyed results such as core petrography and physical logging. The radar range due to reflection was about 25m(20MHz) and 18m(60Hz). But the measurable range was variable for existence and conditions of fissures. For example, this range was 15m(20Hz) and 10m(60Hz) in the upper zone of the borehole. Thus, the radar process is effective to survey fissures in granite and hereafter the application of this technique to many sites is necessary to establish the survey method and to research propagating charcteristics of electromagnetic wave in rocks in Japan. (6 figs, 2 tabs, 3 refs)

5305 (SEGJ—8801, pp 310-312) **Airborne MSS data processing for multichannel SWIR sensor.** Urai, Minoru; Yamaguchi, Yasushi. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

This paper describes the specification of an airborne multichannel spectrum scanner (MSS) and data processing. MSS has 13 channels of frequencies in the visible - heat infrared region. The channels 1 - 3 correspond to a visible image, the channels 4, 5 to the absorption bands of iron oxides, the channels 6 - 9 (2.2 (m)m band) to the absorption bands of O-H group and carbonates, and the channels 10 - 13 to absorption bands in the heat infrared region. By the least squares residual (LSR) method, a mineral having an absorption band of 2.2 (m)m was further examined. As a result, the LSR image displayed an orange-colored portion. This portion was identified to correspond to epidote. Silica, which has an absorption band of 8 - 10 (m)m in the heat infrared region, was displayed in blue color. A high frequency resolution sensor has a great potential for discrimination and identification of minerals. (2 figs, 2 tabs, 2 refs)

5306 (SEGJ—8801, pp 313-316) **Digital line detection for high spatial resolution satellite images.** Sakai, Minoru; Sato, Isao. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Satellite images are utilized for lineament, texture and spectrum analyses in geology. In some cases, high spatial resolution images are subjected to lineament analyses. This study proposes a method of detecting a linear pattern of a high spatial resolution image. This method comprises the following four steps: edge detection, thin-line representation, connection of line elements, and display of a line pattern. For the edge detection, a new method by which the valley portions of an image are detected by utilizing the direction of sun illumination is proposed. For the thin line representation, a simple method utilizing the directional properties of the line elements is proposed. Into the connection algorithm of the line elements, a concept of connection cost is introduced. By this method, a relatively long line pattern can be detected from a high spatial resolution image. However, the calculation method for cost necessary for the connection of line elements should be further improved. (5 figs, 4 refs)

5307 (SEGJ—8801, pp 317-322) **New textural analysis method to evaluate periodicity.** Ninomiya, Yoshiki; Sato, Isao; Urai, Minoru. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

A analytical method of image data from earth observing satellite was studied. This method results new data series by rough visualization of data series and can evaluate the periodicity of the original data series from a relationship between the rough visualization degree(scale of sight) and the secondary finite difference for the data series. The relationship between the scale of sight(SS) and the averaged absolute value of the secondary finite difference for data series is called as the SS-d_2 relationship. The method in which all SS-d_2 relating groups are simply averaged, is expressed as method 1 and the method to extract SS values that make d_2 values maximum and to express these in polar coordinate is expressed as method 2. The former is the method to gently express the SS-d_2 relationship of images but informations concerning data directionalities are lost. The latter maintains informations concerning data directionalities but the effective utilization of feature values becomes problem. Therefore, it is appropriate to evaluate image periodicity by combining these two methods. (10 figs, 7 refs)

5308 (SEGJ—8801, pp 323-325) **Application of entropy operator for textural feature extraction.** Sato, Isao; Urai, Minoru. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Geological interpretation due to satellite image is carried out by the lineament analysis, spectral analysis and textural analysis. Satellite images result images reflecting a topography like TM band

of LANDSAT and geological relief is distinguished by edges on images. Here, the geological division of Izu Ooshima in Japan was carried out by considering that the density of erosion valley correlates to the edge density on the image and by utilizing simple edge density as the textural feature. Entropy operator is used as one of operators to emphasize the edge. The entropy operator is a nonlinear space filter and used to calculate entropy of DN value in a localized area of a image. The edge density image of Izu Ooshima is thought to correspond considerably well to the textural difference. (7 figs, 2 refs)

5309 (SEGJ—8801, pp 326-327) **Data aquisition and processing of geomagnetic field around the rift area in the North Fiji basin.** Joshima, Masato; Tanahashi, Manabu; Kishimoto, Kiyoyuki; Kuwahara, Yasuto; Honza, Eiichi. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

In the examination of the rift which extends nearly in the north-east in the centre of the North Fiji Basin, the data of magnetic anomalies were processed with a microcomputer on the ship. A positive central anomaly was found along the ridge. In the box 1 on the north side of the ridge. The existence of a pair of step precipices about 1000 m long was suggested by the corresponding magnetic anomaly. It was supposed that the seamount containing the steep precipices would be reversed in magnetization. The magnetic charge of basaltic magma obtained by dredging in the seamount was 2.5*10E - 2 emu/cc. The magnetic anomaly, if calculated by using this value, would be more intensive as compared with the measured anomaly. The assumption that the mean magnetic charge is about 5*10E - 3 emu/cc would make it possible sufficiently to explain that the magnetic anomaly is due to the seamount. (3 figs)

5310 (SEGJ—8801, pp 328-332) **Three-dimensional inversion for the interpretation of magnetic anomalies.** Okuma, Shigeo; Makino, Masahiko; Nakatsuka, Tadashi. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The 3-D inversion was applied to the magnetic anomalies in the in-air magnetic data over Izu Oshima. The magnetic anomalies were approximated to a two-layer magnetic structure composed of a ferromagnetic basement and a non-magnetic upper layer. The total magnetic anomalies were converted through an electromagnetic filter to pseudo gravity anomalies and polar regional anomalies.The depth of the boundary surfaces was inverted. The average depth of the magnetic basement was 1100 m lower than the observation level, and the standard deviation was 240 m. An belt-shaped elevation in the magnetic basement which extended across Izu Oshima in the NW-SE direction was found. In the center of Izu Oshima, the magnetic basement was nearly in coincidence with the topography, while near the sheashore, the magnetic basement was distributed at several hundred meters depth of the ground surface, and did not coordinate with the topography with inevitable errors, that is, accompanied with the fact that the average depth of the magnetic base at the periphery was as high as the sea surface level and also, the magnetic base caused some fluctuation. By this method, 3-D modeling of magnetic structures can be easily conducted, and can be combined with other interpretation methods. For example, dipole type magnetic anomalies with short wavelength are determined by other method, and anomalies with long wavelength corresponding to the complex topography by this method. The calculation results are combined and arranged. This will bring high-accuracy interpretation of magnetic anomalies. (6 figs, 5 refs)

5311 (SEGJ—8801, pp 333-336) **Aeromagnetic survey in the south region of the northern offshore of Miyako island.** Makino, Masahiko; Okuma, Shigeo; Nakatsuka, Tadashi. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Aeromagnetic survey in the northern offshore of Southwest Islands had been carried out by the Geological Survey of Japan since 1982 and the survey in the south region of northern offshore of Miyako Island was carried out in 1987. The aviation base was placed on the nearest Miyako Airport and the diurnal variation station was also placed on Miyako Island. The total working flight time amounted to 20 hours and 40 minutes, the flight altitude was 1,500m and total travel line amounted to about 3,100km. It was found from the survey that short wave high amplitude positve magnetic anomalies were located along the edge of the Tunghai Shelf and ran as a whole to NE-SW direction. Further, medium wave high magnetic anomalies ran nearly to EW direction, from the Tunghai Shelf to the edge of continental shelf. This area is thought to correspond to the boundary line, separating the Tunghai Shelf sedimentary basin. Futhermore, magnetic anomalies corresponding to the plateau in the Tunghai Shelf slope were found. (7 figs, 1 tab, 4 refs)

5312 (SEGJ—8801, pp 337-339) **Ground magnetic test survey in the north of Chiba-prefecture.** Nakatsuka, Tadashi; Okuma, Shigeo; Makino, Masahiko. (Geological Survey of Japan, Ibaraki, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

It was found in the ground survey in 1987 that there was a characteristic anomaly pattern trending ENE-WNW at test survey lines B and C in the North of Chiba Prefecture. Detailed geomagnetic mapping was carried out in 1988 at this site to clarify the manetic anomalies. It was revealed from the results that the actual structure was more complicated than expected. But except high magnetic anomalies at the center of west side, the trend close to east-west direction was found as a whole and a neighboring structure was found to be regulated by the major structure in ENE-WSW direction. The magnetic anomalies may occur by the local geological conditions up to 50mm depth at most from the variation pattern. This local geological condition is thought to be horizontal magnetic variation of a superficial deposit or to be a relief of geological boundary between the Quaternary Period deposit and the Tertiary Period deposit. (7 figs)

5313 (SEGJ—8801, pp 346-351) **Gravity interpretation for cave by horizontal gradient.** Kasai, Hiroyuki; Tonouchi, Shoji; Sano, Shun'ichi. (Kawasaki Geological Engineering Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Gravity interpretation for a cave by vertical gradient had the advantage of separating a shallow cave from large scale gravity anomaly. Based on an idea that horizontal gradient obtained from values measured at short spacing should also have same advantage, gravity anomaly and its derivatives were calculated using a three-dimensional cubic prism model. A horizontal gradient profile was derived from gravity anomaly values measured at a short spacing, and using the maximum amplitude and the horizontal distance between the maximum and the minimum value of the profile, a simple procedure for interpretation of a prism type cave was proposed. As this procedure was applied to a gravity anomaly profile measured in the cave area of Oyaishi quarry, it was accompanied by a reasonable result. Analysis of gravity anomaly is sifting toward quantitative analysis using gravity anomaly itself with development of a computer, and the analysis by the prism model with an appropriate algorithm is considered to be helpful the composition of a rapid convergent automatic analyzing system. (3 figs, 5 refs)

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 4832, 4833, 4834, 5321

5314 **(INIS-BR—1319) Geochemical aspects of alkaline massif of Banhadao, PR, Brazil.** Ruberti, E.; Gomes, C.B.; Dutra, C.V. (Sao Paulo Univ. (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 27p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704779/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The alkaline massif of Banhadao, located near Cerro Azul, State of Parana, southern Brazil, occupies an area of about 8 Km/sup 2/ and is constituted by three magnetic associations: a group of mesocratic to leucocratic coarse nepheline syenites (NeS) (melanite NeS, NeS I, and light reddish and grey varieties of NeS II); a second group of medium to fine-grained ultrabasic to basic rocks (phlogopite melteigites and petrologically related malignites and feldspar-melanite ijolites); and a group of fine-grained to aphanitic phonolotic dikes, cutting NeS. The rocks of the complex are miaskitic, showing low concentrations of trace elements (V, Th and mainly REE), lack of rare metal silicates, and relative abundance of apatite and sphene. NeS are distinguished by a differentiation trend in which highly differentiated end members are enriched in alkalis and Al/sub 2/O/sub 3/, with decrease in MgO, FeO (total), CaO and TiO/sub 2/. The less differentiated melanite-rich rocks show higher concentrations in Zr, Nb, Y and V. Phlogopite melteigites and associated rocks show the highest contents of MgO, FeO (total), CaO and TiO/sub 2/, and the lowest concentration of alkalis and Al/sub 2/O/sub 3/; they are significantly enriched in Ba and are the only rocks with detectable amounts of Ni, Cu and Cr. The phonolites are chemically similar to NeS. The Banhadao rocks were probably formed during successive intrusions of two different magmas types. The source of NeS and phonolites was probably a nephelinitic magma, while phlogopite melteigites and related rocks were probably derived from an alkali-enriched ferromagnesian magna. Both parent magmas probably derived by melting of rocks of the lower crust or upper mantle.

5315 **(INIS-BR—1321) Chronostatigraphy of limestone sequence of north Brazilian coast based on data from strontium isotope.** Takaki, T.; Rodrigues, R.; Kawashita, K. (PETROBRAS, Rio de Janeiro (Brazil). Centro de Pesquisas; Sao Paulo Univ. (Brazil)). (Sociedade Brasileira de Geoquimica, Rio de Janeiro (Brazil)). 1987. 9p. (In Portuguese). (CONF-8710388—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704781/JAW.

From 1. Brazilian congress on geochemistry; Porto Alegre, Brazil (30 Oct 1987).

The strontium isotope composition of marine limestones can be a valuable tool for stratigraphic correlation, in addition to other techniques usually employed for this purpose. The technique can render particularly important in sequences where the fossil assemblage do not present good stratigraphic resolution. As examples, data from Mesozoic and Cenozoic limestone sequences of north Brazilian coast are here presented. Data on strontium isotope composition are compared to those obtained by De Paolo and Ingram in another geographic locations.

5316 (SEGJ—8801, pp 269-271) **Study on physical properties of anisotropic rocks.** Fujinaga, Yoshinobu; Kato, Yoshifumi; Rokugawa, Shuichi; Ishii, Yoshinori; Suzuki, Tomoyuki. (The Univ. of Tokyo, Faculty of Engineering, Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the physical properties of anisotropic rocks. The elastic wave velocity of the rockes which were dried or saturated with water was determined. The rock samples were saturated with 3% NaCl aq. solution to determine the resistivity of the samples by 1000 Hz a.c. method. The elastic wave velocity of a fracture model in which the same kind of two samples were separated through water from each other was determined. At a result, the formulation by Willie, et al. was identified which respect to the rocks and the fractures. The wave velocity was 1.5 km/s for the water and 2.7 km/s for the rock samples. When a rock sample containing cracks was pressurized, the elastic wave velocity decreased with the pressure. The electric resistivity was lower with the openings of the fractures enlarged. For a sand rock sample composed of thin layers of which the interspaces between the quartz grains were filled with other minerals, the anisotropic coefficient was 1.03. The resistivity of the thin layers in the perpendicular direction was relatively high. The sample had diagonal cracks into which quartz fine grains were filled. The elastic wave velocity in the perpendicular dirction was considerably lower than that in the horizontal direction. (7 figs, 32 tabs, 9 refs)

5317 (SEGJ—8801, pp 272-275) **On propagation characteristics of elastic wave velocity under stress condition in anisotropic rocks (Part 2).** Taniguchi, Keiichiro; Kusumi, Harushige; Matsui, Yoshinari. (Kansai, Univ., Osaka, Japan; Meiji Consultant Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Examination was made on the propagation characteristics of anisotorpic rocks under stress condition. The sample rocks were chlorite schist produced in the Minami Gawa zone in Nara Prefecture. The rocks had a prominent schistosic structure. A tri-axially compressing apparatus was used. The P wave velocity was measured with an ultrasonic measuring device. The P wave velocity (Vp) in the axial direction of the sample coordinating with a difference (f) of stresses applied in the different axial directions increased with (f) when the (f) was relatively small, and was constant when the (f) exceeded a definite value. These behaviors depended on the confinement pressure. The increment in (P) wave velocity in the compression direction was varied depending on the different inclinations of the schistosity. Vp showed a hyperbolic increasing tendency with the increase of (f). This tendency of Vp was expressed by the following experimental equation: $Vp = f/(a + b \times f) + Vph$ where Vph is a P wave velocity under the isotropic pressure condition a, b are constants. (1/a) represents the increase ratio of Vp. (a) depends on the confinement pressure. (1/b) is a maximum increment in Vp. (7 figs, 2 tabs, 3 refs)

5318 (SEGJ—8801, pp 299-302) **Spectrum of electromagnetic radar pulse through rock.** Sano, Shun'ichi; Kubota, Ryuji; Tonouchi, Shoji; Onuma, Hiroshi. (Kawasaki Geological Engineering Co., Ltd., Tokyo, Japan; S.P.C. Co., Ltd., Ehime, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

Giving attention to experimental results that conductivity of rocks varied with frequency over a radar frequency range (20-1000MHz), permittivity remained almost constant, and the frequency dependence of conductivity was remarkable in dry rocks, the frequency dependence of electromagnetic wave penetration was discussed. Variation of a radar pulse spectrum with penetrating distance and the resulting deformation of the pulse after penetration were calculated by assuming typical frequency dependence types of conductivity. Compensation of pulse form for deformation after penetration, as well as possibility to calculate the frequency dependence of conductivity on the basis of variation of the spectrum were discussed. Two calculated examples of pulse forms and spectra of a typical radar pulse at various distances of rocks and spectrum ratios against spectrum at 1m in distance were illustrated (relative permittivity of rock: 6 and 10, conductivity of rock: 10^{-5}ohm/m and 10^{-4}ohm/m on 20MHz). (2 figs)

5319 (SEGJ—8801, pp 303-304) **Basic investigation of the properties of electromagnetic wave through rock.** Tsubota, Koji; Noritake, Kazumitsu; Tonouchi, Shoji; Onuma, Hiroshi. (Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan; Kawasaki Geological Engineering Co., Ltd., Tokyo, Japan). 17 May 1988. (In Japanese). NTIS (US Sales Only), PC A16/MF A01. Order Number DE88755328/JAW. (CONF-8805220—).

From 78. SEGJ conference; Tokyo, Japan (17 May 1988).

The application of electromagnetic wave to geophysical prospecting of rocks is one of the new techniques. However, various fundamental data of the properties of rocks have not precisely been obtained sufficiently. A purpose of this study is to obtain such data necessary for electromagnetic wave method. The propagation time and the attenuation ratio of electromagnetic wave through granite magma, mudstone, tuff, and the other rocks were measured to determine the permittivity and the attenuation coefficient. Then, the reflection wave of electromagnetic wave against the fracture in the rocks of which the opening was varied was measured to determine the reflection index. Further, for the rocks of which the fractures were filled with water, mud, air, etc. the change in difference between the transmission velocities of electromagnetic wave, and the change in intensity of the reflective wave against the fractures were

determined. The electromagnetic wave velocity of the rocks placed in a water bath was measured to determine the water content of the rocks. The propagation time of electromagnetic wave through the compressed rocks was measured every 10 kg/1cm² loading time in pressure increase to determine the change in permittivity. (2 figs, 2 photos)

5804 Geochemistry

5320 **(INIS-BR—1268) Thermoluminescence study of quartzite in a gold and uranium mineralized zone (Canavieiras, Jacobina-Bahia).** Ferreira, J. (Bahia Univ., Salvador (Brazil)). 1973. 93p. (In Portuguese). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704346/JAW.

The quartzite of Canavieiras gold mine (Jacobina-Bahia, Brazil) shows in its natural glow curve, a high temperature. The study of the reproductibility of this peak resulted in the standartization of measurement for grain sizes between 80 and 100 mesh. "In Situ" total gamma-ray profiles were made using a scintillation detector for the study the distribution of radioactive elements near the pirite, uranium and gold strike. In the interpretation of the profiles it was possible to shown a positive correlation between thermoluminescence and uranium yields. The thermoluminescence peak is sufficiently high temperature peak to let thermoluminescence accumulate at ambient temperatures. It was used in attempt to estimate the time and the event that enitiated the accumulation of thermoluminescence. The result obtained, (7 /sup -/+ 4).10/sup 6/ years, may correspond to the last heating of the rocks at relatively recent time. (C.D.G.).

5321 (INIS-SU—58, pp 31-33) **Application of EhRA-1M X-ray fluorescence analyzers to determining copper and iron in ores of Volkovskij copper-iron-vanadium deposit.** Kuzovnikov, V.N.; Isupov, V.A.; Lavrent'ev, Yu.D.; Shcherbo, Yu.S. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Methodological features of applying EhRA-1M x-ray fluorescence analyser during approximate analysis of complex element composition ores are considered. Comparison of methods based on applying different types of x-ray fluorescence analyzers is carried out. EhRA-1M analyzer advantage when conducting approximate x-ray fluorescence determinations of copper and iron in ores of complex mineralogical composition is demonstrated. The efficiency due to introduction of a single EhRA-1M device into the system of geological preparation and mining of ore makes up 20000 roubles a year. 2 refs.; 1 fig.; 2 tabs.

5805 Oceanography

REFER ALSO TO CITATION(S) 5256

64 PHYSICS I

5322 **(INIS-mf—11328) Annual convention 1988 of the Austrian physical society.** (Oesterreichische Physikalische Gesellschaft, Vienna). 1988. 108p. (In German, English). (CONF-8809186—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW.

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

136 abstracts of oral presentations and posters are given in the fields: atomic molecular and plasma physics; solid state physics; nuclear and particle physics; high-polymer physics; school teachers confirmation training. 68 of them are of INIS scope and are treated separately. (qui).

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 5431, 5546, 5629

5323 **(CONF-8809146—4) Properties of solar gravity mode signals in total irradiance observations.** Kroll, R.J.; Chen, J.; Hill, H.A. (Arizona Univ., Tucson (USA). Dept. of Physics). 1988. Contract FG02-87ER13670. 15p. NTIS, PC A03/MF A01. Order Number DE89003565/JAW.

From Seismology of the sun and sun-like stars; Puerto de la Cruz, Spain (26 Sep 1988).

Further evidence has been found that a significant fraction of the gravity mode power density in the total irradiance observations appears in sidebands of classified eigenfrequencies. These sidebands whose amplitudes vary from year to year are interpreted as harmonics of the rotational frequencies of the nonuniform solar surface. These findings are for non axisymmetric modes and corroborate the findings of Kroll, Hill and Chen for axisymmetric modes. It is demonstrated the the generation of the sidebands lifts the usual restriction on the parity of the eigenfunctions for modes detectable in total irradiance observations. 14 refs.

5324 **(CONF-8809146—5) Inversion of quasi-periodic deviations between low-degree solar gravity mode eigenfrequencies and asymptotic theory eigenfrequencies.** Hill, H.A.; Gao, Qiang; Rosenwald, R.D. (Arizona Univ., Tucson (USA). Dept. of Physics). 1988. Contract FG02-87ER13670. 16p. NTIS, PC A03/MF A01. Order Number DE89003564/JAW.

From Seismology of the sun and sun-like stars; Puerto de la Cruz, Spain (26 Sep 1988).

The fine structure found by Gu, Hill and Rosenwald between asymptotic theory eigenfrequencies and the observed eigenfrequencies reported by Hill and Gu is interpreted as the result of conditions not being met for the applicability of asymptotic theory at one or more radii in the solar interior. From an inversion of the observed fine structure, reasonably good agreement is obtained between observation and theory for either a localized perturbation in internal structure at $r/R \sim 0.06$ or at $r/R \sim 0.23$. The latter solution is, however, the better one. The amplitude of the perturbation in the mean molecular weight required to produce the fine structure is also inferred. 11 refs., 2 figs.

5325 **(DOE/ER/13670—T3) Solar variability observed through changes in solar figure and mean diameter.** Hill, H.A.; Beardsley, B.J. (Arizona Univ., Tucson (USA)). 1988. Contract FG02-87ER13670. 71p. NTIS, PC A05/MF A01. Order Number DE89003082/JAW.

The work performed on solar variability during the last two years at SCLERA is reviewed. That portion of the SCLERA research program supported by the Department of Energy has been directed toward the detection and monitoring of climatically significant solar variability by accurate measurement of the variability in solar shape and diameter. Observations were obtained in 1987 and 1988 and results from analysis of earlier observations obtained. Systematic long term changes in the apparent solar diameter and/or radius have been detected and these changes were found to strongly correlate with long term changes in solar total irradiance. Evidence for changes in the solar convection zone over a six-year period has also been obtained. Additional evidence for gravity mode coupling has been found which may be important to understanding neutrino and fusion energy production rates in the solar core. Each of these findings may be important to anticipating future changes in the solar luminosity. Progress has been made in setting up an international network based on SCLERA type instruments to improve the coverage and quality of the observations. A proposal is made for the continuation of support from the Department of Energy for further studies relevant to solar-variability forecasting. 75 refs., 5 figs., 3 tabs.

5326 (INIS-mf—11328, pp 14) **Supernova 1987 A.** Straumann, N. (Zurich Univ. (Switzerland). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5327 **(UCRL—21128) A model for extremely powerful extragalactic water masers.** Wu, Ying-Cheng; Alcock, C. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 104p. NTIS, PC A06/MF A01. Order Number DE89002653/JAW.

The reasons for the differences between extremely powerful extragalatic water masers (EPEWMs) and strong Galactic H_2O masers are discussed. This model quite successfully explains many important characteristics of EPEWMs; the rapid time variations, the broad range and random velocity distribution, the extremely high luminosities, the various heights or widths of features in spectra, the strong infrared radiation from the galaxies, how an active nucleus contributes to an EPEWM, how some parts of EPEWMs producing strong features are pumped, why this pump mechanism can work, and why EPEWMs are different from strong Galactic H_2O masers. Recent observations of extragalactic water masers which have extremely high luminosities raise the possibility that the stimulated emission rate in the maser emission line in these regions is much higher than in Galactic masers. It is possible that the local stimulated emission rate exceeds the local bandwidth for the radiation. In this case the standard expression relating the photon emission rate to the profile averaged mean intensity does not apply. A new expression for the photon emission rate is derived.

5328 **Equation of state and the maximum mass of neutron stars.** Prakash, M.; Ainsworth, T.L.; Lattimer, J.M. (Physics Department, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review Letters;* **61**: No. 22, 2518-2521(28 Nov 1988).

The relationship between the maximum neutron-star mass and observable parameters of the equation of state is explored. In particular, the roles of the nuclear incompressibility and the symmetry energy are considered. It is concluded that, for realistic symmetry energies, the compression modulus cannot, by itself, be severely limited by observed neutron-star masses. Several directions for further study are suggested.

5329 **Topological picture of cosmic-string self-intersection.** Albrecht, A.; York, T. (NASA/Fermilab Astrophysics Center, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 2958-2962(15 Nov 1988).

We translate the problem of finding the self-intersections of an evolving loop of cosmic string into a topological problem. We use this picture to discuss the relationship between cusps and self-intersections and give a lower bound on the total number of self-intersections any particular loop can have. This bound can be calculated by studying only the kinks and cusps present on the loop. We discuss the ways in which the number of cusps and self-intersections can change under smooth deformations of the initial conditions.

5330 **Changing coupling "constants" and violation of the equivalence principle.** Barr, S.M.; Mohapatra, P.K. (Bartol Research Institute, University of Delaware, Newark, Delaware 19716). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3011-3019(15 Nov 1988).

It is shown that a cosmological evolution of coupling "constants" due to a change in some dilaton field (such as the size of the extra dimensions in Kaluza-Klein theories or superstring theories), if observably large, would imply a long-range force of gravitational strength that would violate the equivalence principle. Our analysis is in the context of superstring theories but should be more general. We also clarify various obscurities and correct mistakes in the recent literature.

5331 **Cosmological aspects of the heterotic string above the Hagedorn temperature.** Leblanc, Y. (Center for Theoretical Physics, Laboratory for Nuclear Science dge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3087-3093(15 Nov 1988).

We consider the cosmology of the heterotic string above the grand-unification scale taking into account the thermodynamical phase structure of an ideal gas of heterotic string excitations above the Hagedorn temperature. We find that the Universe expands up to a critical volume a/sub c/^{9} above which the massive (Planckian) excitations should decay into massless excitations (nonequilibrium regime). The Universe then goes on expanding in a radiation-dominated phase with a scale factor $a(t) \sim \beta(t)$. Because the heterotic string is self-dual with respect to temperature, it is argued that there is an induced duality relation for the scale factor a(t).

6402 Atmospheric Physics

REFER ALSO TO CITATION(S) 5572

5332 (ACIESP—60-Vol.1, pp 108) **Observation of high energy electrons and protons on the South Atlantic geomagnetic anomaly by OHZORA satellite.** Nagata, K.; Kohno, T.; Murakami, H.; Nakamoto, A.; Hasebe, N.; Kikuchi, J.; Doke, T. (Tanabe Seiyaku Co. Ltd., Osaka (Japan); Institute of Physical and Chemical Research, Wako, Saitama (Japan); Rikkyo Univ., Tokyo (Japan). Dept. of Physics). 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704411/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

5333 **(FFI—88/1001) Dynamics of the polar mesopause and lower thermosphere region as observed in the night airglow emissions.** Myraboe, H.K. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). Feb 1988. 101p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755659/JAW.

This work utilizes night airglow emissions to deduce temperatures, dynamics, energetics, transport and photochemistry of the polar 80-110 km atmospheric region. The morphological behaviour of the polar 80-110 km region as seen in the night airglow emissions is best described by quasi regular to regular variations in the temperature and in the intensities of the emissions with periods ranging from minutes to a few days. Temperature amplitudes are seen from a few degrees up to +-50 K. Intensity changes up to several hundred percent may occur. Gravity waves from below are generally found to be present in the region, being responsible for much of the short period variations. The long period variations are seen to be related to circulation changes in the lower atmosphere. Stratospheric warmings are generally associated by a cooling of the 80-110 km region by a ratio approximately twice as large in amplitude as the heating at the 10 mbar level. The semidiurnal tide is found to be dominant with a peak to peak amplitude of about 5 K, in contrast to model calculations. Effects from geomagnetic phenomena on the energetics and dynamics of the region are not seen and, if present, have to be small or rare as compared to the influence from below. There is a mesopause temperature maximum at winter solstice. Pronounced differences in the day to day and seasonal behaviour of the odd oxygen associated nightglows at the North and South Pole are found. This may indicate fundamental differences at the two poles in the winter mesopause region circulation and energetics. Reprints of ten previously published papers; 55 refs.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 5552, 5608

5334 **(CONF-881151—32) Production and transport of convoy electrons in amorphous carbon foils.** Gibbons, J.P.; Elston, S.B.; DeSerio, R.; Biedermann, C.; Breinig, M.; Gonzalez-Lepera, C.E.; Heil, O.; Huelskoetter, H.P.; Rothard, H.; Sellin, I.A.; Vane, C.R. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics and Astronomy; Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE89002313/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The production of free convoy electrons, emitted with velocities near the ion velocity in ion-solid collisions, is not well understood. Experiments concerning thickness-dependent yields have suggested the dominant mechanism for convoy production is electron loss to the continuum (ELC) in the bulk of the solid. Free electrons created in the bulk are subject to multiple elastic and inelastic scattering during transport through remaining layers of the solid. We discuss doubly-differential measurements of convoy measurements of convoy electrons as a function of target thickness for fast O^{5+} ion projectiles incident on carbon foils of varied thicknesses. Angular distributions confirm the ELC model for convoy production. From the radial broadening of the convoy cusps we have determined energy and angular spreading parameters due to post-collisional multiple scattering. 8 refs., 2 figs., 1 tab.

5335 **(CONF-881151—33) Comparison of the target-thickness dependence of the convoy electron yield and the Rydberg electron yield measured in coincidence with exit charge states in fast ion-solid collisions.** Gaither, C.C. III; Breinig, M.; Freyou, J.; Underwood, T.A. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 11p. NTIS, PC A03/MF A01. Order Number DE89002267/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

We have simultaneously measured the yield of convoy electrons and the yield of electrons in high Rydberg states of the projectile (n {approx←gt} 70), produced by 2MeV/u C projectiles passing through C foils, whose thicknesses range from 4--10 ug/cm², for incident charge states q/sub i/ = 4--6 and exit charge states q/sub e/ = 4--6. We have found that these yields exhibit similar trends as a function of foil thickness, but that, nevertheless, the ratio of the number of convoy electrons detected in coincidence with ions of exit charge state q/sub e/ to the number of electrons detected in high Rydberg states of ions with the same exit charge state is a function of foil thickness. This may be due to a broadening of the convoy electron energy spectrum with increasing foil thickness. 6 refs., 3 figs.

5336 **(CONF-881151—34) Properties of cold ions produced by synchrotron radiation and by charged particle impact.** Levin, J.C.; Biederman, C.; Cederquist, H.; O, C.S.; Short, R.T.; Sellin, I.A. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 13p. NTIS, PC A03/MF A01. Order Number DE89002331/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Argon recoil ions produced by beams of 0.8 MeV/u Cl^{5+} have been detected by time-of-flight (TOF) techniques in coincidence with the loss of from one to five projectile electrons. Recoil-ion energies have been determined to be more than an order of magnitude higher than those of highly-charged ions produced by unmonochromatized synchrotron radiation. Charge-state distributions, however, show similarities, suggesting that loss of projectile electrons corresponds, in some cases, to inner-shell target ionization producing vacancy cascades. In an essential improvement to the usual multinomial description of ionization in the independent-electron-ejection model, we find the inclusion of Auger vacancy cascades significantly alters the description of the recoil ion spectra corresponding to projectile-electron loss. These conclusions are consistent with impact parameters inferred from determinations of mean recoil energy. 11 refs., 5 figs.

5337 **(CONF-881151—37) Energy- and angled-resolved photoelectron spectroscopy of negative ions.** Pegg, D.J.; Thompson, J.S.; Compton, R.N.; Alton, G.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 14p. NTIS, PC A03/MF A01. Order Number DE89003103/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

Energy- and angle-resolved photoelectron detachment spectroscopy is currently being used to investigate the structure of negative ions and their interaction with radiation. Measurements of the electron affinity of the Ca atom and the partial cross sections for photodetachment of the metastable negative ion, $He^-(1s2s2p^4P)$, are reported. 5 refs., 5 figs.

5338 **(CONF-881151—38) Mechanisms for $v/2$ electron emission in ion-atom collisions.** Wang, Jianyi; Burgdoerfer, J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 15p. NTIS, PC A03/MF A01. Order Number DE89003152/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

We have studied electron emission spectra in ionizing collisions in one dimension with interaction potentials of zero range. From low to intermediate collision energies the ionization mechanism is attributed to promotion of quasi-molecular orbitals formed between the collision partners into the continuum. At intermediate collision velocities we observe a hump in the ionization spectrum near v/sub e/≅v/2. The peak position follows approximately the motion of an improper saddle point as the charges of the projectile and of the target are varied. Double peak structures are observed at low collision energies in the forward emission spectra which can be traced to interferences between resonances in the projectile and target continuum. 17 refs., 4 figs.

5339 **(DOE/ER/10371—9) Negative ion detachment cross sections: Progress report, March 1, 1985--February 29, 1988.** Champion, R.L.; Doverspike, L.D. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics). Aug 1987. Contract AS05-79ER10371. 15p. NTIS, PC A03/MF A01. Order Number DE89003303/JAW.

The purpose of the experimental investigations undertaken during the past three years was to perform an extensive and comprehensive study of the collisional dynamics of reactants which involve collisions of negative ions and neutral atomic and molecular targets. The (laboratory) collision energies for these studies ranged from about 1 eV up to 500 eV and the experiments involved measurements of both absolute total cross sections and doubly-differential cross sections. The various processes investigated included electron detachment, charge transfer, dissociative charge transfer and reactive (or rearrangement) scattering. Reactants which were the subject of these investigations included the negative ions O/sup minus/, S/sup minus/, Na/sup minus /, K/sup minus/, Cs/sup minus/, H/sup minus/, D/sup minus/ in collisions with H_2, D_2, O_2, N_2, CO, CO_2, CH_4 and the alkali atoms Na, K and Cs.

5340 **(DOE/ER/13844—1) [Reactive collisions of high-temperature systems]: Progress report.** Graff, M.M. (Georgia Inst. of Tech., Atlanta (USA)). 15 Sep 1988. Contract FG05-88ER13844. 8p. NTIS, PC A02/MF A01. Order Number DE89003377/JAW.

We are developing an experiment to study the reactive collisions of systems with large activation barriers or endothermicities. The basis design involves the collision of fast radicals with a stable reactant gas (hydrogen) in a collision cell. Initially, products will be detected by ionization and mass analysis. Later, laser-induced fluorescence will be used to probe internal states of products. Studies will include an investigation of rotational effects by comparing results for rotational levels J = O and 1 of molecular hydrogen. 2 figs.

5341 **(GSI—88-45-Prepr.) Nuclear polarization contribution to the Lamb-shift in heavy atoms.** Plunien, G.; Mueller, B.; Greiner, W.; Soff, G. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Frankfurt Univ. (Germany, F.R.). Inst. fuer Theoretische Physik; Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1988. 11p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755572/JAW.

The energy shift of the 1s/sub 1/2/-state in /sup 238//sub 92/U due to virtual excitation of nuclear rotational modes is shown to be considerable correction for atomic high precision experiments. In contrast to this nuclear polarization effects are of minor importance for Lamb-shift studies in /sup 208//sub 82/Pb.

5342 (INIS-mf—11328, pp 66) **Deviations from exponential decay in the Weisskopf-Wigner model of spontaneous emission.** Seke, J.; Herfort, W. (Technische Univ., Vienna (Austria). 1. Inst. fuer Theoretische Physik; Technische Univ. Vienna, Institut fuer Angewandte und Numerische Mathematik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5343 (IPPCZ—277/I, pp 31-33) **Extension of the applicability of the existing collisional-radiative models for rare gas plasmas.** Vlcek, J. (Vysoka Skola Strojni a Elektrotechnicka, Plzen (Czechoslovakia)). Jul 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

The numerical method developed makes it possible to solve numerous rate equations for excited level populations in connection with the Boltzmann equation and thus to extend the applicability of the existing extensive collisional-radiative models for rare gas plasmas to a region in which the electron distribution function is no longer Maxwellian. The excited level populations and electron energy distribution functions are calculated using a 65 level collisional-radiative model for a partially-ionized non-equilibrium argon plasma with the following parameters: Electron temperature 20,000 K, neutral and ion temperature 300 K, neutral density 1,61.10/sup 16/ cm/sup -3/, and electron density ranging from 10/sup 10/ cm/sup -3/ to 10/sup 16/ cm/sup -3/. (J.U.). 2 figs., 1 tab., 8 refs.

5344 **(LA—11436-M-Vol.1) Theoretical atomic physics code development I: CATS: Cowan Atomic Structure Code.** Abdallah, J. Jr.; Clark, R.E.H.; Cowan, R.D. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 27p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004144/JAW.

An adaptation of R.D. Cowan's Atomic Structure program, CATS, has been developed as part of the Theoretical Atomic Physics (TAPS) code development effort at Los Alamos. CATS has been designed to be easy to run and to produce data files that can interface with other programs easily. The CATS produced data files currently include wave functions, energy levels, oscillator strengths, plane-wave-Born electron-ion collision strengths, photoionization cross sections, and a variety of other quantities. This paper describes the use of CATS. 10 refs.

5345 **(UCRL—53887) Space and time resolved spectroscopy of laser-produced plasmas: A study of density-sensitive x-ray transitions in helium-like and neon-like ions.** Young, Bruce Kai Fong. (Lawrence Livermore National Lab., CA (USA)). Sep 1988. Contract W-7405-ENG-48. 357p. NTIS, PC A16/MF A01. Order Number DE89002928/JAW.

The determination of level populations and detailed population mechanisms in dense plasmas has become an increasingly important problem in atomic physics. In this work, the density variation of line intensities and level populations in aluminum K-shell and molybdenum and silver L-shell emission spectra have been measured from high-powered, laser-produced plasmas. For each case, the density dependence of the observed line emission is due to the effect of high frequency electron-ion collisions on metastable levels. The density dependent line intensities vary greatly in laser-produced plasmas and can be used to extract detailed information concerning the population kinetics and level populations of the ions. The laser-plasmas had to be fully characterized in order to clearly compare the observed density dependence with atomic theory predictions. This has been achieved through the combined use of new diagnostic instruments and microdot targets which provided simultaneously space, time, and spectrally resolved data. The plasma temperatures were determined from the slope of the hydrogen-like recombination continuum. The time resolved electron density profiles were measured using multiple frame holographic interferometry. Thus, the density dependence of K-shell spectral lines could be clearly examined, independent of assumptions concerning the dynamics of the plasma. In aluminum, the electron density dependence of various helium-like line intensity ratios were measured. Standard collisional radiative equilibrium models fail to account for the observed density dependence measured for the "He/sub α//IC" ratio. Instead, a quasi-steady state atomic model based on a purely recombining plasma is shown to accurately predict the measured density dependence. This same recombining plasma calculation successfully models the density dependence of the high-n "He/sub γ// He/sub β/" and "He/sub δ//He/sub β/" helium-like resonance line intensity ratios.

5346 **(UCRL—99437) Model microfield calculations of radiative and transport properties of ions in strongly coupled plasmas.** Boercker, D.B. (Lawrence Livermore National Lab., CA (USA)). 26 Aug 1988. Contract W-7405-ENG-48. 24p. (CONF-8807121—1). NTIS, PC A03/MF A01. Order Number DE89001244/JAW.

From 7. international conference on spectral line shapes; Torun, Poland (25 Jul 1988).

The radiative and transport properties of a strongly coupled plasma are closely related because they are both determined by the behavior of the electric microfield seen by the ions. By focusing on the dynamics of the microfield, a simple, unified model of both types of properties has recently been developed. This model will be described here and shown to reproduce both the static and impact limits of ion Stark broadening. In between these extremes, comparisons with computer simulation data for both the electric field and the radiator dipole autocorrelation functions will be made. 21 refs., 9 figs.

5347 **Direct evidence from gas-phase atomic spectra for an unscreened intra-atomic origin of outer-core multiplet splittings in solid manganese compounds.** Hermsmeier, B.; Fadley, C.S.; Krause, M.O.; Jimenez-Mier, J.; Gerard, P.; Manson, S.T. (Department of Chemistry, University of Hawaii, Honolulu, Hawaii 96822). *Physical Review Letters;* **61**: No. 22, 2592-2595(28 Nov 1988).

We compare for the first time gas-phase 3s and 3p spectra from atomic Mn with corresponding spectra from the solid compounds MnF_2 and MnO. These spectra are found to be strikingly similar, indicating that the solid-state spectra have a domoinant origin in unscreened intra-atomic multiplet splittings, perhaps with correlation-induced satellites. Such outer-core hole states are thus not describable in terms of a simple superposition of fully screened and poorly screened spectra as recently proposed.

5348 **Comment on "Asymmetries in above-threshold ionization".** Lambropoulos, P.; Tang, X. (Physics Department, University of Southern California, Los Angeles, California 90089-0484). *Physical Review Letters;* **61**: No. 21, 2506-2506(21 Nov 1988).

A Comment on the Letter by M. Bashkansky, P. H. Bucksbaum and D. W. Schumacher, Phys. Rev. Lett. 60, 2458 (1988).

5349 **Damped-core quantum Monte Carlo: Effective treatment for large-Z systems.** Hammond, B.L.; Reynolds, P.J.; Lester W.A. Jr. (Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory Department of Chemistry, University of California, Berkeley, California 94720). *Physical Review Letters;* **61**: No. 20, 2312-2315(14 Nov 1988).

A quantum Monte Carlo simulation method is introduced which treats core and valence electronsn separately. This greatly minimizes problems associated with the very different energy and time scales present even at moderate atomic number. The core is treated variationally by Metropolis sampling of a trial wave function, while the chemically important valence region is treated by a quantum Monte Carlo algorithm that solves the Schroedinger equation. We calculate ionization potentials and electron affinities of C, Si, and Ge, and find excellent agreement with experiment. Effective speedup over standard quantum Monte Carlo approaches is estimated as large as a factor of 5000.

6404 Fluid Physics

5350 **(LA-UR—88-3681) The properties of tagged lattice fluids: II. Velocity correlation functions.** Binder, P.M.; d'Humieres, D.; Poujol, L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-8809128—2). NTIS, PC A02/MF A01. Order Number DE89003475/JAW.

From Workshop in discrete kinetic theory; Torino, Italy (20 Sep 1988).

We report preliminary measurements of the velocity autocorrelation function for a tagged particle in a lattice gas. These measurements agree with the Boltzmann-level theory. The Green-Kubo integration of these measurements agrees with theoretical predictions for the diffusion coefficient. To within the error bars of the simulations (3 {times} 10/sup {minus}3/) we observe no long-time tails. 9 refs., 1 fig., 1 tab.

5351 **(LA-UR—88-3703) Is there a statistical mechanics of turbulence?.** Kraichnan, R.H.; Chen, S.Y. (Los Alamos National Lab., NM (USA)). Sep 1988. Contract W-7405-ENG-36. 32p. (CONF-8805120—4). NTIS, PC A03/MF A01. Order Number DE89003471/JAW.

From CNLS conference on advances in fluid turbulence; Los Alamos, NM, USA (16 May 1988).

The statistical-mechanical treatment of turbulence is made questionable by strong nonlinearity and strong disequilibrium that result in the creation of ordered structures imbedded in disorder. Model systems are described which may provide some hope that a compact, yet faithful, statistical description of turbulence nevertheless is possible. Some essential dynamic features of the models are captured by low-order statistical approximations despite strongly non-Gaussian behavior. 31 refs., 5 figs.

5352 **(LA-UR—88-3851) Determination of momentum distributions from deep inelastic neutron scattering experiments: A Bayesian study.** Sivia, D.S.; Silver, R.N. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8810118—1). NTIS, PC A02/MF A01. Order Number DE89003493/JAW.

From Workshop on momentum distributions; Argonne, IL, USA (24 Oct 1988).

A Bayesian analysis shows that the determination of momentum distributions in quantum fluids and solids by deep inelastic neutron scattering is an extremely ill-posed problem. The argument is illustrated with the issue of the Bose condensate fraction in superfluid ^{4}He. 10 refs., 4 figs.

5353 **(SAND—88-8257) Summary of discussions at the eleventh meeting of the Sandia cooperative group on the aerothermochemistry of turbulent combustion.** Dibble, R.W.; Lucht, R.P. (Sandia National Labs., Livermore, CA (USA)). Oct 1988. Contract AC04-76DP00789. 51p. (CONF-8803165—Summs.). NTIS, PC A04. Order Number DE89001846/JAW.

From 11. meeting of the Sandia Cooperative Group on the aerothermochemistry of turbulent combustion; Livermore, CA, USA (29 Mar 1988).

A turbulent reacting flow working group has been established through the sponsorship of the Department of Energy, Office of Basic Energy Sciences, Division of Chemical Sciences. The purpose of this group is to establish and maintain a strong interaction and active dialogue between workers currently involved in modeling turbulent reacting flows and those involved in related experiments. One objective of this collaboration is to develop an increased understanding of the fundamental interaction between the chemical and fluid dynamical processes occurring in chemically reacting flows and to utilize this understanding to improve predictive capabilities for turbulent combustion. Regular members, who represent academia, private industry, and national laboratories, and guests participate in the meetings. Several guests are invited to each meeting to provide an influx of different ideas and opinions to the discussions. This document is a summary of the discussions that took place during the eleventh meeting, which was held at Sandia National Laboratories, Livermore, California, March 29-30, 1988.

5354 **(UCRL—21114) Applications of large-eddy simulation: Synthesis of neutral boundary layer models.** Ohmstede, W.D. (Lawrence Livermore National Lab., CA (USA)). Dec 1987. Contract W-7405-ENG-48. 50p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003388/JAW.

The object of this report is to describe progress made towards the application of large-eddy simulation (LES), in particular, to the study of the neutral boundary layer (NBL). The broad purpose of the study is to provide support to the LES project currently underway at LLNL. The specific purpose of this study is to lay the groundwork for the simulation of the SBL through the establishment and implementation of model criteria for the simulation of the NBL. The idealistic NBL is never observed in the atmosphere and therefore has little practical significance. However, it is of considerable theoretical interest for several reasons. The report discusses the concept of Rossby-number similarity theory as it applies to the NBL. A particular implementation of the concept is described. Then, the results from prior simulations of the NBL are summarized. Model design criteria for two versions of the Brost LES (BLES) model are discussed. The general guidelines for the development of Version 1 of the Brost model (BV1) were to implement the model with a minimum of modifications which would alter the design criteria as established by Brost. Two major modifications of BLES incorporated into BV1 pertain to the initialization/parameterization of the model and the generalization of the boundary conditions at the air/earth interface. 18 refs., 4 figs.

5355 **Plasmas with a single sign of charge.** O'Neil, T.M. (Department of Physics, University of California, San Diego, La Jolla, CA 92093). *AIP (American Institute of Physics) Conference Proceedings;* **175**: No. 1, 1-25(10 Nov 1988). (CONF-8803133—).

From Nonnetral plasma physics; Washington, DC, USA (28 Mar 1988).

The theory of totally unneutralized plasmas is reviewed. In principle such plasmas can be confined forever and can come to a state of thermal equilibrium that is guaranteed to be stable and quiescent. The plasma can be cooled to the cryogenic temperature range where theory predicts that the plasma becomes a liquid and (at even lower temperature) a crystal. The cryogenic plasmas make accessible the parameter regime of strong magnetization, in which a many particle adiabatic invariant constrains the collisional dynamics. Also, cross magnetic field particle transport is novel in these plasmas. These topics are discussed theoretically and are related to relevant experiments (discussed in these proceedings by other authors).

5356 **Waves and instabilities in nonneutral plasmas.** Davidson, R.C. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *AIP (American Institute of Physics) Conference Proceedings;* **175**: No. 1, 139-208(10 Nov 1988). (CONF-8803133—).

From Nonnetral plasma physics; Washington, DC, USA (28 Mar 1988).

This paper presents a survey of the equilibrium, stability and collective oscillation properties of magnetically-confined nonneutral plasma. Emphasis is placed on summarizing several of the technical advances that have occurred in both theory and experiment since the early 1970's.

5357 **Numerical simulation of nonneutral plasmas.** Mankofsky, A. (Science Applications International Corporation, McLean, VA 22102). *AIP (American Institute of Physics) Conference Proceedings;* **175**: No. 1, 246-269(10 Nov 1988). (CONF-8803133—).

From Nonnetral plasma physics; Washington, DC, USA (28 Mar 1988).

We discuss particle-in-cell simulation techniques and their applicability to problems involving nonneutral plasmas. An overview of the essential elements of a particle simulation is presented, followed by a series of examples of present-day code capabilities.

5358 **Experiments with pure electron plasmas.** Malmberg, J.H.; Driscoll, C.F.; Beck, B.; Eggleston, D.L.; Fajans, J.; Fine, K.; Huang, X.h.; Hyatt, A.W. (Department of Physics, University of California at San Diego, La Jolla, CA 92093). *AIP (American Institute of Physics) Conference Proceedings;* **175**: No. 1, 28-71(10 Nov 1988). (CONF-8803133—).

From Nonnetral plasma physics; Washington, DC, USA (28 Mar 1988).

A series of experiments at UCSD on pure electron plasmas is described. The apparatus and methods of measurements are discussed. Results are given on various wave experiments including the dispersion of electron plasma waves, feedback growth and damping of the l = 1 diocotron wave, and the unstable growth of diocotron waves on plasmas with hollow radial profiles. The nonlinear saturation of diocotron waves, subsequent vortex merging and the decay of the resulting two-dimensional turbulence are observed. Transport processes resulting from both the single particle and collective response of the plasma to externally imposed field asymmetries have been studied. Evolution of the confined plasma to thermal equilibrium has been observed and scaling of the rate of this evolution with magnetic field has been measured. The relaxation rate of an anisotropic velocity distribution has been measured in both the usual parameter regime and the cryogenic regime where the rate is greatly reduced due to the existence of a many particle adiabatic invariant.

5359 **Fast numerical method for solving the three-dimensional Stokes' equations in the presence of suspended particles.** Fogelson, A.L.; Peskin, C.S. (Department of Mathematics, University of Utah, Salt Lake City, Utah 84112). *Journal of Computational Physics;* **79**: No. 1, 50-69(Nov 1988).

A new fast numerical method for solving the three-dimensional Stokes' equations in the presence of suspended particles is presented. The fluid dynamics equations are solved on a lattice. A particle is represented by a set of points each of which moves at the local fluid velocity and is not constrained to lie on the lattice. These points are coupled by forces which resist deformation of the particle. These forces contribute to the force density in the Stokes' equations. As a result, a single set of fluid dynamics equations holds at all points of the domain and there are no internal boundaries. Particles size, shape, and deformability may be prescribed. Computational work increases only linearly with the number of particles, so large numbers (500—1000) of particles may be studied efficiently. The numerical method involves implicit calculation of the particle forces by minimizing an energy function and solution of a finite-difference approximation to the Stokes' equations using the Fourier—Toeplitz method. The numerical method has been implemented to run on all CRAY computers: the implementation exploits the CRAY's vectorized arithmetic, and on machines with insufficient central memory, it performs efficient disk I/O while storing most of the data on disk. Applications of the method to sedimentation of one-, two-, and many-particle systems are described. Trajectories and settling speeds for two-particle sedimentation, and settling speed for multiparticle sedimentation from initial distributions on a cubic lattice or at random give good quantitative agreement with existing theories. copyright 1988 Academic Press, Inc.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 5322

5360 **(DOE/ER/05096—31) High energy: Progress report, March 1, 1988--February 28, 1989.** Bonner, B.E.; Roberts, J.B. Jr. (Rice Univ., Houston, TX (USA). Dept. of Physics). 1 Nov 1988. Contract AS05-76ER05096. 167p. NTIS, PC A08/MF A01. Order Number DE89002745/JAW.

We report on the considerable progress made for the period May 31, 1987, to November 1, 1988, for DOE Contract No. AS05-76ERO5096. Included here are final results from analysis of jet production from FNAL E609, and progress in preparing the new jet experiment E683. We report further spin polarization measurements using the polarized proton beam at Brookhaven (E817) and initial results from the recently commissioned polarized proton and anti-proton beams at Fermilab (E581/704). Our future plans are discussed in the accompanying Renewal Proposal. The format we will follow is to have a brief writeup on each individual experiment and to include in the appendices copies of published papers or manuscripts which give much greater detail. The aim is to concentrate on the physics goals, results and their significance in the main body of the report. In the section on Instrumentation Development, we mention the significant improvement in our computing power made possible by grants from the Shell Foundation and our University. This has had a substantial impact on our ability to design experiments as well as to analyze the data in a timely fashion.

5361 **(DOE/ER/10336—8) Investigations in particle and field theory: Progress report, December 1, 1986--November 30, 1988.** Haller, K.; Islam, M.M.; Mannheim, P.D.; Caldi, D.G. (Connecticut Univ., Storrs (USA)). 1988. Contract AC02-79ER10336. 17p. NTIS, PC A03/MF A01. Order Number DE89003004/JAW.

Progress for the period December 1, 1986--November 30, 1988 is reported in various aspects of particle and field theory. The implications for future research are discussed. The work described includes investigations into topological features and the dynamics of gauge theory, lattice gauge theory, nucleon structure, novel spontaneous symmetry breaking modes, and general relativity and cosmology. 5 refs.

5362 **(DOE/ER/40325—50) [Experimental studies of elementary particle interactions at high energies]: Report of technical progress, [October 1, 1987 to approximately September 30, 1988].** Khuri, N.N.; Sanda, A. (Rockefeller Univ., New York (USA)). [1988]. Contract AC02-87ER40325. 30p. NTIS, PC A03/MF A01. Order Number DE89002716/JAW.

This paper discusses research in the areas of quantum field theory, CP violation and B physics, quark mixing and Majorana particles, and string theory. (LSP)

5363 **(INIS-SU—62/A) 7. International symposium on high energy spin physics. Vol. 2.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. 244p. (CONF-8609151—). NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW.

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Individual papers in these proceedings are indexed separately.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 5475, 5507, 5508, 5524, 5640

5364 **(BNL—41992) Dynamical symmetry breaking: Exotic quarks and the strong CP problem.** Furlong, R.C. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 2p. (CONF-8808145—13). NTIS, PC A02/MF A01. Order Number DE89003570/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Decuplet quarks (quens) transforming as 10's under SU(3)/sub C/ are shown to be superior to sextet quarks (quixes) in their ability to resolve the Strong CP problem, resulting in composite invisible axions (CIAs). 8 refs.

5365 **(BNL—41993) Hadroproduction of the Iota Meson observed in the K/sub s/K/sub s/π0 final state.** Cason, N.M.; Bensinger, J.R.; Bishop, J.M.; Biswas, N.N.; Busenitz, J.K.; Etkin, A.; Foley, K.J.; Fortner, M.R.; Fortney, L.R.; Goo, J.; Goshaw, A.T.; Kenney, V.P.; Kirsch, L.E.; Kramer, M.A.; Lindenbaum, S.J.; Longacre, R.S.; Love, W.A.; McCrory, E.M.; Morris, T.W.; Piekarz, H.; Piekarz, J.; Platner, E.D.; Poster, R.A.; Rath, M.G.; Robertson, W.J.; Ruchti, R.C.; Saulys, A.C.; Shephard, W.D.; Zogrofou, P. (Brookhaven National Lab., Upton, NY (USA); Notre Dame Univ., IN (USA); Brandeis Univ., Waltham, MA (USA); City Coll., New York (USA); Duke Univ., Durham, NC (USA)). 1988. Contract AC02-76CH00016. 6p. (CONF-880862—3). NTIS, PC A02/MF A01. Order Number DE89003568/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (28 Aug 1988).

Results from an experiment studying the C=+1K/sub s/K/sub s/π/sup O/ system produced π/sup {minus←plus}/p interactions at 21.4 GeV/c are presented. It is shown that the structure present in the data between 1.4 and 1.5 GeV/c^2 has mass and width consistent with the (1460) observed in J/{PSI} radiative decay and most probably has J/sup PC/=O/sup {minus←plus}/. 19 refs., 7 figs., 1 tab.

5366 **(CERN-EP—88-105) Precise determination of the lifetime of the charmed baryon Λ/sub c/.** Barlag, S.; Becker, H.; Boehringer, T.; Bosman, M.; Castillo, V.; Chabaud, V.; Damerell, C.; Daum, C.; Dietl, H.; Gillman, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 26 Aug 1988. 14p. (CONF-880867—10). NTIS (US Sales Only), PC A03 - OSTI. Order Number DE89003199/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

We present the result on the measurement of the lifetime of the Λ/sub c/ from a sample of Λ/sub c/ decays obtained in the NA32 experiment in 1985 and 1986 using charge-coupled devices for vertex reconstruction and a trigger on Λ/sub c/→pK$^-\pi^+$ (and charge conjugate). We observe a peak of 108 bias- free events at the Λ/sub c/ mass on a background of 7 events. The lifetime of the Λ/sub c/ is determined to be 1.96+-/sub 0.20//sup 0.23/ {dot}10^{-13}. 15 refs., 11 figs.

5367 **(CERN-EP—88-125) An experimental review of direct protons.** Camilleri, L. (European Organization for Nuclear Research, Geneva (Switzerland)). 23 Sep 1988. 13p. (CONF-8806260—3). NTIS (US Sales Only), PC A03. Order Number DE89003184/JAW.

From 19. international symposium on multiparticle dynamics - new data and theoretical trends; Arles, France (13 Jun 1988).

Recent results on direct photons from collider and fixed-target experiments are presented and compared with a next-to-leading order calculation. The agreement is very good, provided a soft gluon and Λ = 200 MeV are used in the calculation. Results on angular distributions, on photon-jet distributions, and on low-mass dimuons are also discussed. New results on photon pair production from three experiments are also in agreement with theory. An anomalous production of low-z and low-p/sub T/ photons in Deep-Inelastic Muon Scattering is reported. 28 refs., 21 figs., 1 tab.

5368 **(EFI—966(16)-87) Theoretical aspects of the reasons for producing continuous and intensive electron beams at the Erevan Physics Institute accelerator.** Aznauryan, I.G.; Bagdasaryan, A.S.; Gevorkyan, S.R. and others. (Erevanskij Fizicheskij Inst. (USSR)). 1987. 62p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704320/JAW.

The basic aspects of modern elementary particle physics, which can be investigated at a heavy-current electron accelerator of intermediate energies, are considered. The problems of new boson spectroscopy and their photoproduction (electroproduction) at the accelerator, pion photoproduction on nucleons and dybaryon resonances are discussed. 31 refs.; 11 figs.; 6 tabs.

5369 **(IAE—4253/2) Positron spectrum of the inverse beta decay at a distance of 18m from the Rovno reactor.** Bogatov, S.A.; Ketov, S.N.; Klimov, Yu.V.; Kopejkin, V.I.; Ozerov, K.V.; Sinev, V.V.; Tolokonnikov, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1986. 20p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704330/JAW.

Positron spectrum of the inverse beta decay reaction ν-tilde/sub e/ + p->e/sup +/ + n was measured. The experiment was performed in neutrino laboratory of Rovno NPP at the distance of 18 m from core center. Limitations on Pontekorvo oscillation parameters are presented. None of calculated e/sup +/ spectra describes the experiment satisfactorily. Sensitivity of the method for oscillation search at one fixed distance is low due to great uncertainty in ν-tilde/sub e/ spectrum knowledge. 26 refs.; 11 figs.; 4 tabs.

5370 **(IAE—4433/2) Search for neutrino oscillations in measurements of ν-bar/sub e/ spectra at two distances from the Rovno reactor (division method).** Ketov, S.N.; Kopejkin, V.I.; Mikaehlyan, L.A.; Tolokonnikov, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704331/JAW.

Devision method was used for comparative analysis of positron spectra of ν-tilde/sub e/ + p->e/sup n/ + n reaction, measured at distances of 18 m and 25 m from the Rovno reactor. The method is characterized by high sensitivity to neutrino oscillations in major part of parameter region, where oscillations are observed, according to the data, obtained at Bugey reactor (France). Limitations on oscillation parameters obtained on the basis of spectrum analysis don't support the results of Bugey group. 6 refs.; 4 figs.; 2 tabs.

5371 **(IAE—4434/2) Search for unusual phenomena in ν-bar/sub e/ flux of the Rovno reactor.** Ketov, S.N.; Skorokhvatov, M.D.; Tolokonnikov, S.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1987. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704332/JAW.

The experiment at Rovno reactor resulted in limitations on unusual radiation types and phenomena for a model-free case using an antineutrino spectrometer and two CsI crystals. Experimental estimates are illustrated using the example of electromagnetic neutrino decay and the model of standars axion. 10 refs.; 1 fig.; 1 tab.

5372 **(IC—88/253) Graphical analysis of clusters in the Lobachevsky velocity space.** El-Naghy, A.; Ramadan, S.; Abdel-Aziz, S.S. (Cairo Univ., Giza (Egypt). Physics Dept.). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 3p. (CONF-880766—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704757/JAW.

From 5. international conference on clustering aspects in nuclear and subnuclear systems; Kyoto, Japan (25 Jul 1988).

A graphical method based on a geometric formulation of relativistic kinematics in patterns of the Lobachevsky velocity space is used for the analysis of clusters produced in high-energy hadron-nucleus collisions. 3 refs, 2 figs.

5373 (INIS-mf—11328, pp 14) **Measurement of the neutrino mass.** Kuendig, W. (Zurich Univ. (Switzerland). Inst. fuer Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5374 (INIS-mf—11328, pp 59) **Measurement of the electric polarizability of the neutron.** Schmiedmayer, J.; Rauch, H.; Riehs, P. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5375 (INIS-mf—11328, pp 79) **Search for turbulence patterns in high-energy many-particle reactions (UA1 experiment at CERN).** Lipa, P. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5376 **(INIS-mf—11821) Determination of nucleon structure functions from neutrino-iron scattering.** Falkenburg, B. (Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). 3 Dec 1986. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE88755405/JAW.

In the present thesis from inelastic neutrino-iron scattering the nucleon structure functions 2xF/sub 1/, F/sub 2/, xF/sub 3/, anti q are determined. The data acquisition was performed 1983 at CERN in the 400 GeV neutrino broad-band beam with the improved CDHS detector. The statistics could be essentially raised against the last CDHS structure-function measurement. (orig./HSI).

5377 **(INIS-mf—11833) Measurement of the inclusive production of hyperons in the energy range of the Y resonances by the ARGUS detector.** Scheck, H. (Dortmund Univ. (Germany, F.R.). Fachbereich Physik). 2 Mar 1988. 234p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88755412/JAW.

In this thesis the measurement of the inclusive cross section of octet and decuplet hyperons by decays of Y1S, Y2S, and Y4S states produced in e/sup +/e/sup -/ annihilation at DORIS is described. (HSI).

5378 (INIS-SU—62/A, pp 137-141) **New experiment on precise comparison of the anomalous magnetic momenta of relativistic electrons and positrons.** Vasserman, I.B.; Vorob'ov, P.V.; Gluskin, E.S. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

At present the anomalous magnetic moment (AMM) of electron and positron is measured to a high precision of {similar←to}x10/sup -8/ in the magnetic traps, wherin single particles were captured with energies of milli-electronvolt range. A significant feature of this experiment is taking measurements in the electron-positron storage ring VEPP-2M at particles energy of E=650 MeV simultaneously for electrons and positrons kept in the identical conditions, optimally matching the task to compare their AMM. The calculated behaviour of the polarization degree while crossing the resonance with different RF field amplitudes is shown. The lay-out of the intra beam scattered particles counters are presented. The spin frequency difference as a function of electrostatic separation is calculated. The results of the electron and positron μ' comparison obtained while being inferior in accuracy, confirms the data published, in spite of the completely different experimental conditions. Combined consideration of both results gives the best up to data verification of the CPT theorem and the relativistic invariance principle. 7 refs.; 4 figs.

5379 (INIS-SU—62/A, pp 157-158) **Polarization parameters Σ, T, P for γp->π/sup 0/p reaction in the energy range 0.9-1.5 GeV at Θsub π(sup 0)//sup cms/=120 deg.** Asaturyan, M.M.; Ekizyan, V.A.; Golendukhin, A.L. and others. (Erevanskij Fizicheskij Inst. (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

In this work some results on the Σ, P and T parameters measurements in the double polarization experiment of the beam-target type are presented for the γp -> π/sup 0/p reaction at the pion c.m.s. angle 120 deg and photon energies E/sub γ/=0.9; 1.2; 1.5 GeV. The experiment was carried out on the linearly polarized photon beam of Yerevan synchrotron with the energy 4.5 GeV using the KhPTI polarized proton target. To extract the investigated process the techniques of recoil proton detection in coincidence with one γ-quantum from π/sup 0/-meson decay were used. Energy dependence of Σ, T and P parameters in reaction γp -> π/sup 0/p is shown. 6 refs.; 1 fig.

5380 (INIS-SU—62/A, pp 65-67) **Asymmetry in pair pion production in reaction π/sup -/+p->π/sup 0/π/sup 0/+n on polarized target at 40 GeV/c.** Apokin, Yu.I.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

An attempt to present the systematic dependence of the polarization asymmetry A(m,t) in the reaction π/sup -/+p -> π/sup 0/π/sup 0/+n on the mass of a neutral C-parity system π/sup 0/π/sup 0/ within the specified interval of t' for smaller and larger masses of the f/sub 2/(1270) has been made. The results on the asymmetry in pion production on polarized target at 40 GeV/c has been shown. 4 refs.; 2 figs.

5381 (INIS-SU—62/A, pp 68-70) **Asymmetry measurements in reaction π/sup -/parrow up->a/sub 2/(1320)n at 40 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The experiment on asymmetry measurements in the reaction π/sup -/p/sub arrow up/ -> a/sub 2/(1320)n was carried out at 40 GeV/c and the values of {vert←bar}{vert←bar}up to 0.8 (GeV/c)/sup 2/ γ's from the decay of a/sub 2/ -> (π/sup 0/ -> γγ)+(eta -> γγ) were detected. It should be noted that the cross section of the reation is small 10/sup -31/ cm/sup 2/. The results on asymmetry A(t) equals (-41+-15%) at {vert←bar}{vert←bar}0.2-0.4 (GeV/c)/sup 2/ and is compatible with zero at {vert←bar}{vert←bar}0-0.2 and 0.4-0.8 (GeV/c)/sup 2/. 2 refs.; 2 figs.

5382 (INIS-SU—62/A, pp 71-73) **Measurements of two body processes at 90deg.** Russell, J.J. (Southeastern Massachusetts Univ., North Dartmouth (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The first measurements at 90 deg of K and p-bar scattering, of K and delta production, and of rho alignment are carried out. Missing mass distributions for π/sup -/p -> X/sup -/p and π/sup +/p -> π/sup +/x/sup +/ has shown. the extraction of elastic scattering, rho and delta production at 10 GeV is illustrates. results on the decay distributions of rho/sup -/ -> π/sup -/+π/sup 0/ are presented. 8 refs.; 2 figs.; 1 tab.

5383 (INIS-SU—62/A, pp 74-77) **Measurement of A/sub NN/ in parrow upparrow up elastic scattering between 13 and 18.5 GeV/c.** Grabb, D.G. (Michigan Univ., Ann Arbor (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The polarized proton beam facility at the AGS at Brookhaven National Laboratory has been used to measure A/sub nn/ in p/sub arrow up/ + p/sub arrow up/ -> p+p at 13, 16.5 and 18.5 GeV/c. The experiment was part of a continuing series to investigate spin parameters in pp elastic scattering at energies above that reached with ZGS at Argonne National Laboratory. The results on A/sub nn/ at large P/sub perpendicular/ are well known and showed that values of {similar←to}60% were achieved at large P/sub perpendiculr/ (>or approx. 4.5 (GeV/c)/sup 2/). 9 refs.; 4 figs.

5384 (INIS-SU—62/A, pp 83-85) **Asymmetry in the inclusive reaction π/sup -/parrow up->π/sup 0/X at high p/sub T/ at 40 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The results on measuring the π/sup 0/-meson raw asymmetry in the inclusive reaction π/sup -/P/sub arrow up/ -> π/sup 0/X at 40 GeV/c in the p/sub T/ region 1.2 < p/sub T/ < 3 (GeV/c) and {vert←bar}/sub F/{vert←bar}< 0.1 are presented. The experiment was carried out at the IHEP accelerator. The experimental setup is shown. Essential raw asymmetry {similar←to}3% was observed in the given p/sub T/-region. The rough estimate of the dilution factor gave 8-10. If it is so this value can be transformed to -(25-30)%. The standard quark hard scattering models with incoherent dynamics cannot provide a complete description, as they lead to a zero asymmetry. 5 refs.; 2 figs.

5385 (INIS-SU—62/A, pp 89-92) **Asymmetry in the hypercharge change reaction K/sup -/+parrow up->π/sup 0/+X for the beam fragmentation region at 40 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The beam fragmentation region in the reaction K/sup -/+p/sub arrow up/ -> π/sup 0/+X on a polarized target has been studied. The experiment was carried out at the Serpukhov accelerator at 40 GeV/c. The polarized proton target with a mean polarization value of 80% was used. 8x10/sup 5/ π/sup 0/-mesons were used to calculate the raw polarization asymmetry. The data are shown for two p/sub T/-regions. No essential p/sub T/-dependence is observed. The raw symmetry separately for 2γ-events (25% from all the statistics) and for events with n/sub γ/ ≧3 is presented. 4 refs.; 2 figs.

5386 (INIS-SU—62/A, pp 93-96) **First data on measuring the polarization asymmetry in the inclusive reaction p-barparrow up->π/sup 0/X at 40 GeV/c.** Apokin, V.D.; Arestov, Yu.I.; Belikov, N.I. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The results on measuring the raw polarization asymmetry (without taking into account the target dilution factor) in the reaction p-tilde+p/sub arrow up/ -> π/sup 0/+x at 40 GeV/c in the kinematic region 0.2<x<1 and p/sub T/≦ GeV/c are reported. The experiment was carried out in 1985-1986 on a polarized target with a mean polarization of {similar←to}80%. To determine the raw asymmetry on the polarized propane-diol target, about 5x10/sup 5/ "clean' π/sup 0/'s were used. The p-tildep/sub arrow up/ results are shown. The raw asymmetries are equal to -(1-2)% in the x <or approx. 0.6 region and are equal to (1-1.5)% at x >or approx. 0.6. Thus the first pp/sub arrow up/ data give and indication of the non-zero single spin asymmetry even in the forward hemisphere (with polarized target). The result contradicts the expectations in the frame of multiperipheral models. In the quark models there can be a subprocess qq -> q'q with the following qq-tilde/sub sea/ -> π/sup 0/ hadronization. 4 refs.; 4 figs.

5387 (INIS-SU—62/A, pp 99-101) **Angular dependence of the polarization correlation parameter A/sub oonn/ and asymmetry A/sub ooon/ in the elastic pp-scattering in the energy region 0.69-0.95 GeV.** Efimovykh, V.A.; Fedorov, O.Ya.; Kovalev, A.I. and others. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Angular dependences of the polarization correlation parameter A/sub oonn/ and asymmetry A/sub ooon/ have been measured in the angular range 30-90 deg c.m. at 0.69, 0.85, 0.89, 0.95 GeV. The experiment has been carried out on the Leningrad Nuclear Physics Institute synchrocyclotron using a polarized proton beam (P/sub B/=0.3) and a frozen spin polarized proton target (P/sub T/=0.85). The goals of the experiment were to check the ratio of the triplet to singlet pp-elastic cross sections near the maximum of its energy dependence at 0.7 GeV and to collect the data which could allow us to perform a Phase Shift Analysis (PSA) in a region 0.8-1.0 GeV.The 0.69 GeV data were compared with the results of previous measurements of A/sub oonn/. The value of the A/sub oonn/(0.69 GeV, 90 deg) was defined using the value of the polarization in a pp-elastic scattering P(0.69 GeV, 45 deg)=0.516 which was used for the determination of a beam polarization. The averaged value of A/sub oonn/(0.69 GeV, 90 deg) from two experiments is <A/sub oonn/>=0.804+-0.040. This value corresponds to the ratio of the triplet to singlet pp-scattering cross sections a=(9+2.5)-(9-1.7). 3 refs.; 2 figs.

5388 (INIS-SU—62/A, pp 105-106) **Measurement of polarization transfer parameter K/sub noon/ in pp-scattering in energy range 800-970 MeV.** Borisov, N.S.; Vovchenko, V.G.; Efimovykh, V.A. and others. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The polarization transfer parameter K/sub noon/(Θ has been measured in the energy range 0.8-0.97 GeV at the LNPI synchrocyclotron. The obtained results together with the differential cross section, polarization and spin correlation parameter A/sub oonn/ allow one to determine modules of spin amplitudes and to perform the phase shift analysis. The energy of the unpolarized proton beam was reduced by polyethylene blocks to 0.97, 0.90, 0.85, 0.80 GeV. The beam was scattered at the "frozen-spin" proton target. The target polarization was measured with the accuracy of 0.5% using the NMR method. The angular dependence of the parameter D/sub nono/(Θ=K/sub noon/(π-Θ at 0.80, 0.85 and 0.90 GeV is given. Measurements of D/sub nono/(K/sub noon/) at 0.85 and 0.90 GeV are performed for the first time, and results at 0.80 and 0.97 GeV are checked with the previously measured data. The energy dependence of K/sub noon/(90 deg)=D/sub nono/(90 deg) in energy range 0.4-1.0 GeV is given. This dependence does not show any resonance structure is contrast to the energy dependence of A/sub oonn/(90 deg), but results of the phase shift analysis including present data are compatible with the resonance-likeE-dependence of /sup 1/D/sub 2/ and /sup 3/F/sub 3/ phase shifts. 9 refs.; 2 figs.

5389 (INIS-SU—62/A, pp 107-110) **Measurement of parity nonconservation in the proton-proton total cross section at 800 MeV.** Bowman, J.D. (Los Alamos National Lab., NM (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The results of an experiment that searched for parity nonconservation (PNC) in the scattering of 800 MeV longitudinally polarized protons from an unpolarized hydrogen target are reported PNC arises from an interference between the strangeness-conserving weak interaction and the strong interaction and results in a change in the total cross section when the helicity is reversed. The longitudinal asymmetry A/sub L/ for p/sub pol/-p scattering to

date, and it achieves a sensitivity in the measured value, A/sub L/ =(+2.4+-1.1+-0.1)x10/sup -7/. 25 refs.; 2 figs.; 1 tab.

5390 (INIS-SU—62/A, pp 114-115) **Measurements of the pp analyzing power A/sub oono/ in a large angular region between 0.88 and 2.7 GeV.** Perrot, F.; Fontaine, J.M.; Ball, J. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); 9100652FR). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The pp analyzing power was measured simultaneously with the spin correlation parameter A/sub oonn/(pp) using polarized proton beam and the Saclay frozen spin polarized target. In the analysis A/sub oono/=A/sub ooon/ was assumed, as required, by TRI. The measurements at 0.88 and 1.1 GeV were carried out in the angular region 25 deg ≦Θsub CM/ ≦60 deg. These data complete previous measurements in the angular range of Θsub CM/ from 45 deg to 90 deg. Between 1.3 and 2.7 GeV the measurements were performed in two overlapping angular region: 25deg ≦Θsub CM/ ≦55 deg and 50 deg ≦Θsub CM/ ≦95 deg. The shape of the angular distribution changes considerably with increasing energy. The evolution of the angular distribution A/sub oono/=f(Θ or A/sub oono/=f(-t) is discussed in a separate contribution to this conference concerning the t-dependence of A/sub oono/ at all energies. 1 fig.

5391 (INIS-SU—62/A, pp 116-117) **Measurement of the spin correlation parameter A/sub oonn/(pp) in a large angular region between 0.88 and 2.7 GeV.** Bystricky, J.; Chaumette, P.; Deregel, J. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Using polarized proton beam and the Saclay frozen spin polarized target, the parameter A/sub oonn/(pp) was measured at 0.88, 1.1, 1.3, 1.6, 1.8, 2.1, 2.4 and 2.7 GeV. The measurements carried out at the first two energies in the angular region 24 deg ≦Θsub CM/ ≦60 deg complete the previous data at Θsub CM/ from 45 deg to 90 deg. Between 1.3 and 2.7 GeV the measurements were performed in two overlapping angular regions: 25 deg ≦Θsub CM/ ≦55 deg and 50 deg ≦Θsub CM/ ≦95 deg. The value of A/sub oonn/ at 90 deg CM decreases from A/sub oonn/ ≅0.57 at 0.88 GeV to A/sub oonn/ ≅0.42 at 1.3 GeV and starts to rise again. It reaches its maximum of ≅0.52 at 1.8 MeV and decreases to ≅0.35 at 2.7 GeV. 1 fig.

5392 (INIS-SU—62/A, pp 118-119) **Energy dependence of the spin correlation parameter A/sub ookk/(pp) at 90 deg CM.** Bystricky, J.; Chaumette, P.; Deregel, J. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The measurement of the spin correlation parameter A/sub ookk/(pp) with the longitudinally polarized proton beam and the frozen spin target was carried out at 1.3, 1.6, 1.8, 2.1, 2.4 and 2.7 GeV incident beam energy. The data were measured in the angular region 20 deg - 100 deg CM. Energy dependence of A/sub ookk/(pp) at Θ90 deg CM are presented. The data are compared with previous results in the energy range 0.88-1.1 GeV. 1 fig.

5393 (INIS-SU—62/A, pp 120-121) **Measurement of spin transmission parameters using longitudinally polarized beam and target and analyzing the recoil nucleon polarization in pp elastic scattering at T/sub kin/0.88 GeV.** Bystricky, J.; Chaumette, P.; Deregel, J. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The first results of double scattering experiments measuring also the recoil proton polarization are presented. Polarized proton beam of 0.88 GeV kinetic energy with longitudinal polarization was incident on the Saclay frozen spin target polarized along the beam direction. Elastic scattering events on polarized protons were registered in the range 50 deg < Θsub CM/ < 90 deg. The beam-target spin correlation A/sub ookk/ had been obtained from the event rates for beam and target polarizations parallel and antiparallel, respectively, integrating over final particle spin states. The angular dependence of the parameters P/sub onoo/ (recoil proton polarization for unpolarized beam and target), K/sub os"ko/, D/sub os"ok/ (beam-recoil and target-recoil transmission parameters respectively), N/sub onkk/ (triple spin correlation) for pp elastic scattering at 0.88 GeV are measured. 2 refs.; 1 fig.

5394 (INIS-SU—62/A, pp 122-123) **T-dependence of polarization in pp elastic scattering at all energies.** Lehar, F.; de Lesguen, A.; Perrot, F.; van Rossum, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

From new measurements in the energy range from T=1.1 to 2.7 GeV becomes evident that t-dependence of polarization P in pp inelastic scattering actually exists already at the lowest energies where the corresponding t-values are permitted by kinematics (t(max) reversible ΘCM)=90 deg). This suggests that the explanation should be formulated in a language not specific to the hihg energy region where {vert←bar}{vert←bar}<< s, but applying equally well at much lower energies where the same t-interval corresponds to a large range of CM angles and where {vert←bar}{vert←bar}is of the same order of magnitude as s. For the s-dependence at fixed t it was well known that the large positive polarization in the first maximum progressively vanishes with increasing s, and that in the dip region the polarization changes to negative values at T {similar←to}30 GeV. 1 fig.

5395 (INIS-SU—62/A, pp 124-125) **Measurement of n-p analyzing power A/sub oono/ using the deuteron polarized beam of Saturne 2.** Lehar, F.; de Lesquen, A.; van Rossum, L.; Perrot, F.; Ball, J.; Ghazikhjanian, V.; Gordon, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); 9100652FR; California Univ., Los Angeles (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Both the np and the pp analyzing powers were measured simultaneously using the SATURNE II polarized deuteron beam at 0.550, 0.725, 0.900 and 1.15 GeV/nucleon. the results for the pp analyzing power coincide with the free pp elastic scattering data. 2 figs.

5396 (INIS-SU—62/A, pp 126-127) **Measurement of the spin correlation parameter A/sub oonn//sup d/ (np) and the analyzing power A/sub oono//sup d/(np) using the deuteron polarized beam of Saturne 2.** Lehar, F.; de Lesquen, A.; van Rossum, L. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The np and pp spin correlation parameters A/sub oonn//sup d/ were measured simultaneously using the Saclay frozen spin target and the Saturne II polarized deuteron beam at 0.75, 0.80 and 0.60 GeV/nucleon. For both np and pp scattering, the values of the analyzing power A/sub oono//sup d/ were extracted. Preliminary results at 0.744 GeV at the centre of the target are shown. The data for the pp analyzing power and the pp spin correlation parameter coincide with the free pp elastic scattering data. 2 figs.

5397 (INIS-SU—62/A, pp 128-129) **Measurement of the spin dependent neutron-proton total cross section differences Δ4v/sub T/ and Δ4v/sub L/ at 630 MeV.** Lehar, F.; de Lesquen, A.; van Rossum, L. and others. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Spin dependent total cross sections were measured in a transmission experiment at SATURNE II. The polarized beam of free neutrons (P/sub B/=50%) was obtained from the break-up of 1.3 GeV polarized deuterons. The spin dependent neutron-proton total cross section differences Δ4d/sub T/ and Δ4d/sub L/ at 630 MeV are obtained. Experimental set-up is presented. 3 figs.

5398 (INIS-SU—62/A, pp 130-131) **Measurement of spin observables in pion-nucleon scattering at LAMPF.** Sadler, M.E.; Engelage, J.; Kim, G.K. and others. (Abilene Christian Univ., TX (USA); California Univ., Los Angeles (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The main experimental groups currently active in studying of pion-nucleon system and spin observables in pion-nucleon scattering are at LAMPF and Leningrad. Groups from each laboratory have measured differential cross sections and analyzing powers, A/sub N/, for π/sup +/p -> π/sup +/p and π/sup -/p -> π/sup -/p. The LAMPF groups have also measured these observables for the charge exchange reaction, π/sup -/p -> π/sup 0/n. There are active groups from each laboratory involved in measuring the spin rotation parameters, A and R, by scattering from targets which are polarized in the scattering plane and measuring the components of polarization of the recoil proton in that plan. 15 refs.; 1 fig.

5399 (INIS-SU—62/A, pp 132-133) **Measurement of spin rotation parameters R and A in πp elastic scattering.** Bekrenev, V.S.; Beloglazov, Yu.A.; Gaditskij, V.G. and others. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Measurement of the spin-rotation parameters R and A is a part of LNPI program for study of pion-nucleon interaction in the region of low-lying resonances. Results of the measurement of the spin rotation parameters in π/sup -/p elastic scattering at 450 MeV are presented. The obtained results agree within the experimental errors with the predictions of current phase-shift analyses. 3 refs.; 1 tab.

5400 (INIS-SU—62/A, pp 134-136) **Asymmetry of the π/sup -/parrow up elastic scattering in the central angular region at (1.4-2.1) GeV/c.** Budkovskij, P.E.; Cherkalina, T.S.; Dobrov, V.M. and others. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The systematic measurements of the asymmetry in π/sup -/parrow up elastic scattering in the central angular region have been performed as the ITEP accelerator at momenta from 1.4 to 2.1 GeV/c. The goal of this work was to obtain detailed data for improvement of the partial-wave analysis (PWA) and baryon resonances systematics in the mass region of (1.9-2.2) GeV/c/sup 2/. Large polarization effects are observed in the whole momentum range. The angular dependence varies considerably with momentum. The minimum position is displaced from cosΘsub cm/=-0.1 to cosΘsub cm/ =-0.3 in the interval (1.43-2.0) GeV/c. The minimal asymmetry depends on momentum shows the minimum near 1.8 GeV/c. The asymmetry value in this point is close to -1. Starting from 2 GeV/c another minimum is observed at positive values of cosΘsub cm/. 7 refs.; 2 figs.

5401 **(JYFL—9/88) Probes of collective behavior of dense hadronic matter.** Ruuskanen, P.V. (Jyvaeskylae Univ. (Finland). Dept. of Physics). Jun 1988. 18p. (CONF-8805142—45). NTIS (US Sales Only), PC A03. Order Number DE89003208/JAW.

From 3. international conference on the intersections between particle and nuclear physics; Rockport, ME, USA (14 May 1988).

Collective transverse flow in the central rapidity region of ultrarelativistic heavy ion collisions is described briefly. The effects of flow on transverse momentum spectra are discussed with special emphasis on the correlation between the average transverse momentum and the scaled multiplicity, 1/A dN/dy. In the case of unequal nuclei or noncentral collisions the mass number A is related to the transverse dimension of the overlapping collision region. Transverse momentum dependence of the {rho} peak in the dilepton spectrum is directly related to the flow of pions whereas for the kaons and nucleons nonequilibrium phenomena may change the p/sub T/ correlations predicted from the flow. 19 refs., 9 figs.

5402 **(SLAC-PUB—4709) The spectroscopy of mesons containing strange quarks.** Aston, D.; Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashii, H.; Iwata, S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 6p. (CONF-880862—4). NTIS, PC A02. Order Number DE89003786/JAW.

From BNL workshop on glueballs, hybrids and exotic hadrons; Upton, NY, USA (28 Aug 1988).

Recent results from a high statistics study with LASS of mesons which contain strange quarks are reviewed, and compared with the quark model. 13 refs., 16 figs.

5403 **(SLAC-PUB—4725) Aspects of e^+e {sup{minus}} physics at 1 TeV.** Kennedy, D.C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 10p. (CONF-8806265—1). NTIS, PC A02/MF A01. Order Number DE89002843/JAW.

From 12. Johns Hopkins workshop on current problems in particle theory: TeV physics; Baltimore, MD, USA (8 Jun 1988).

A summary of several recent studies of electroweak e^+e/sup {minus}/ physics is provided. The significance of upcoming SLC/LEP measurements of Z and W properties is discussed, with special emphasis placed on radiative corrections and polarization. New electroweak physics at a proposed TeV e^+e/sup {minus}/ collider is presented as a natural outgrowth of the SLC/LEP programs. Precise tests of the trilinear gauge boson vertex through W pair production, searching for the disturbance of perturbative unitarity by radiative corrections, and of the gauge structure of a Z', through polarized e/sup {minus}/ beams, are presented. 19 refs.

5404 **(SLAC-PUB—4773) Recent results in strangeonium spectroscopy.** Aston, D.; Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashii, H.; Iwata, S. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-8808145—7). NTIS, PC A02/MF A01. Order Number DE89002834/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Data from exclusive s{bar s} meson final states are shown. The data were obtained in a 4.1 ev/nb exposure of K^-p interactions at 11 GeV/c in the LASS spectrometer at SLAC. The results from the analyses of these data is presented and the spectrum of strangeonium states is discussed. 8 refs., 8 figs.

5405 **(SLAC-PUB—4793) Preliminary results from ASP on tests of QED to order α4 in e^+e^- annihilation at $\sqrt{s}$ = 29 GeV.** Hawkins, C.A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 2p. (CONF-8808145—8). NTIS, PC A02/MF A01. Order Number DE89002812/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Tests of QED to order α^4 performed with the ASP detector at PEP are presented. Measurements have been made of exclusive

$e^+e^-e^+e^-$, $e^+e^-\gamma\gamma$ and $\gamma\gamma\gamma\gamma$ final states with all particles above 50 milliradians with respect to the e^+e^- beam line. These measurements represent a significant increase in statistics over previous measurements. All measurements agree well with theoretical predictions. 5 refs., 1 tab.

5406 **Search for multitrack nucleon decay.** Seidel, S.; Bionta, R.M.; Blewitt, G.; Bratton, C.B.; Casper, D.; Ciocio, A.; Claus, R.; Dye, S.T.; Errede, S.; Foster, G.W.; and others. (The University of California, Irvine, Irvine, California 92717). *Physical Review Letters;* **61**: No. 22, 2522-2525(28 Nov 1988).

We report new limits on the nucleon lifetime obtained with the Irvine-Michigan-Brookhaven water Cherenkov detector. Techniques in track fitting, particle identification, and invariant-mass reconstruction provide information about multitrack events which leads to a significant reduction in background for most decay modes. Data obtained during the initial 417-day run and during the subsequent 69-day run with enhanced light collection are discussed. A background subtraction is made, yielding 90%-confidence-level lower bounds on the nucleon partial lifetime per branching fraction in the range (0.6—46.0) x 10/sup 31/ yr for 23 decay channels.

5407 **Limits on KsubL^0→$\pi^0e^+e^-$ and K/sub L/^{0}→e^+e^-.** Jastrzembski, E.; Larsen, R.C.; Leipuner, L.B.; Morse, W.M.; Greenlee, H.B.; Kasha, H.; Mannelli, E.B.; Mannelli, M.; Ohl, K.E.; Schaffner, S.F.; and others. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **61**: No. 20, 2300-2303(14 Nov 1988).

We report on a search for the flavor-changing neutral-current decays K/sub L/^{0}→$\pi^0e^+e^-$ and K/sub L/^{0}→e^+e^-. Limits obtained for these processes are B(K/sub L/^{0}→$\pi^0e^+e^-$) <3.2 x 10/sup -7/ and B(K/sub L/^{0}→e^+e^-)<1.2 x 10/sup -9/.

5408 **Shypit et al. reply.** Shypit, R.L.; Bugg, D.V.; Lee, D.M.; McNaughton, M.W.; Silbar, R.R.; Stewart, N.M.; Clough, A.S.; Hollas, C.L.; McNaughton, K.H.; Riley, P.; and others. (Queen Mary College, Mile End Road, London E1chemical bond4NS, United Kingdom). *Physical Review Letters;* **61**: No. 20, 2385-2385(14 Nov 1988).

Concern that relative phases of $^1D_2$, $^3F_3$, and $^3P_2$ NN→NΔ partial waves determined from pp→npπ^+ data from 492 to 796 MeV might allow resonances (dibaryons) has arisen. This comment is a reaffimation of our conclusion against resonances due to interference with the strong $^3P_1$→$^3S_1$ NN→NNπ^+ (Nπ S waves) amplitude because the interaction is strongly repulsive. (AIP)

5409 **(ORNL/tr—88/30) Production and muonic decay of the Z^0 intermediate vector boson in the UA1 experiment.** Leuchs, R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. Translated from dissertation for the attainment of the Doctoral Degree at the Mathematics and Natural Science Faculty of the Christian Albrechts Univ., Kiel. 238p. NTIS, PC A11/MF A01. Order Number DE89003249/JAW.

In the years 1982 to 1985 the intermediate bosons W^{+-} and Z^0 were detected in all the leptonic decay channels. In the present work we examined experimentally the production of the Z^0 in proton-antiproton collisions, followed by decay of the Z^0 into two muons. At present this is possible only in the UA1 experiment. Within the framework of this work I was initially responsible for the correct data readout from the muon detector. For this purpose it was necessary to build a monitoring system based on microprocessors, which could be used to monitor and test our apparatus. This monitoring system contains numerous programs for the diagnosis of the equipment. In the analysis I first selected the Z^0 events in the runs of 1984 and 1985, and then determined the efficiency of this selection. I also participated in setting up the p/sub t//sup μ/ > 15 GeV/c selection. Then the Z^0 sample was tested for completeness, and the background calculated anew. The methods of energy balance and mass fitting were refined and systematized. Thus the production properties and the mass of the Z^0 could be determined for the first time for the entire measurement period of the UA1. The determination of the parameters of the standard model was done by also including the results of analyses from other decay channels of the W and Z bosons. 149 refs., 60 figs., 14 tabs.

5410 (JINR—D-1,2-86-668-Vol.1, pp 243-251) **New experimental data on cumulative particle production by relativistic nuclei.** Bondarev, V.K.; Zarubin, P.I.; Litvinenko, A.G.; Panebrattsev, Yu.A.; Stavinskij, V.S. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Cumulative production of π/sup +/- and k/sup +/-mesons and protons during 8.9 GeV/c momentum proton interaction with /sup 58/Ni, /sup 64/Ni, /sup 64/Zn, /sup 114/Sn, /sup 124/Sn nuclei was investigated. Measurements were conducted for production of particles with 500 MeV/c momentum and 120 deg observation angle. The obtained data testify to the presence of isotope-effect both for protons and π/sup +/-mesons and for k/sup +/-mesons. A-dependence of k/sup -/-meson production cross-sections in pA- and dA-interactions were measured. Kaon momentum was equal to 500 MeV/c, observation angle - 61 deg. A-dependence of cumulative k/sup -/-meson production is characterized by the same behaviour as A-dependence of cumulative pion production. It was concluded, that cross-section of k/sup -/-meson production, as well as cross-section of π-meson production, were proportional to quark-parton structure function of the nucleus. Experiment on searching cumulative antiprotons in proton-nucleus interactions on lend and aluminium targets was performed. Primary proton momentum was equal to 8.9 GeV/c. Secondary particle momentum was equal to 500 MeV/c. The detection angle - 61 deg. Cross section of antiproton production was evaluated. New experimental data broaden our knowledge about the processes of cumulative particle production. 11 refs.; 11 figs.

5411 (JINR—D-1,2-86-668-Vol.1, pp 252-258) **Ratio of different sign cumulative pion yields in proton-nucleus interactions at high energy.** Belyaev, I.M.; Gavrishchuk, O.P.; Zolin, L.S.; Karev, A.G.; Lobanov, V.V.; Sukhanov, A.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Cumulative pion yields at 159 deg angle in p+/sup 96/Mo -> π/sup +-/+x reaction were investigated by cumulative hadrons spectrometer, using internal target of U-70 accelerator. The following values were obtained: invariant cross section of the reaction ratio (eta) of π/sup -/- and π/sup +/-meson yields for five values of proton energy E/sub p/=20; 25; 30; 38 and 60 GeV; ratio of π/sup -/- and π/sup +/-mesons yields, averaged with respect to the range of proton energy E/sub p/ = 17.5-63 GeV for p/sup +/Mo ->π/sup +-/+x and p+c -> π/sup +-/+x reactions. The ratio of hard pion yields, irradiated in backward direction (Θsub π/ {similar←to}180 deg, q/sub π/ >or approx. 200 MeV/c) is brought up to the steady eta {similar←to}1 level at E/sub p/ ≥4 GeV proton energy, corresponding to the beginning of limiting fragmentation mode. The tendency of slow growth of pion yield ratio is observed with increase of pion momentum. This fact can be interpreted in the framework of the model of quark-spectator fragmentation to pions as manifestation of more rigid momentum distribution of d-quarks with respect to U/sub q/uarks in multiquark nucleus configuration. 11 refs.; 7 figs.

5412 (JINR—D-1,2-86-668-Vol.1, pp 268-272) **Production of high energy cumulative hadrons in proton-nucleus interactions.** Boyarinov, S.V.; Gerzon, S.A.; Kats, M.M. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

New results of measuring invariant cross sections of pA -> pX reaction for 0.6-1.83 GeV/c secondary proton momenta are presented. Experiment was conducted in internal beam of ITEP synchrotron at 5 and 10 GeV proton energies. Dependencies of in-

variant cross section on proton kinetic energy, on X cumulative number were obtained. The dependence of the ratio of invariant cross sections on different nuclei on X, the dependence of universal f/sub 0/ function on X cumulative member are presented. It was concluded, that cumulative processes were described by the universal f/sub 0/ function, independent of mass number of A nucleus and on E/sub o/ initial energy at E/sub o/ >or approx. 10 GeV, parameter of F/sub 0/ function slope doesn't depend on the angle of proton escape for x > 1.8. The observed change of f dependence on Pt and intensive K/sup +/-meson production can testify to formation of a new state of nuclear at achieved energies matter. 15 refs.; 5 figs.

5413 (JINR—D-1,2-86-668-Vol.1, pp 279-287) **Correlations in cumulative proton photoproduction.** Alanakyan, K.V.; Amaryan, M.D.; Asryan, G.A. and others. (Erevanskij Fizicheskij Inst. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Consideration is being given to results of the first experiment on investigating correlation between cumulative photoprotons and forward flying (noncumulative) π/sup +-/-mesons and protons, by studying γ+A -> p-vector+p-vector(π-vector)+X(I) reaction in (p-vectorp-vector) and (p-vectorπ-vector)-coincidences where p-vector-cumulative proton, p-vector (π-vector) - forward flying proton (π/sup +-/ meson), X-residual system. The reaction (I) on /sup 12/C, /sup 27/Al, /sup 63/Cu and /sup 118/Sn nuclei at the maximal energy of bremsstrahlung γ-quanta equal to 4.5 GeV was investigated. Both inclusive and two-particle invariant normalized reaction yields were obtained. A-dependences of inclusive cumulative protons (CP) at P/sub p-vector/=0.4 GeV/c cumulative proton momentum and ν/sub p-vector/=155 deg angle to escape are presented. Possible correlations in cumulative proton production with forward flying protons and π-mesons are investigated. It is proved, that clearly manifested correlation between CP and forward flying hadrons exists during cumulative proton production on nuclei. The obtained data show, that cumulative proton spectra change, depending on the fact, if they are detected inclusively or in coincidence with forward flying hadrons. The following conclusion is made: fragmentating systems (FS), fragmentating in CP, accompanied by forward flying hadrons, are enriched by high-momentum constituents, as compared to FS, fragmentating to inclusive CP. 12 refs.; 5 figs.; 1 tab.

5414 (JINR—D-1,2-86-668-Vol.1, pp 288-292) **Correlations of cumulative protons in hadron-nuclear interactions.** Bayukov, Yu.D.; Vlasov, A.V.; Vorob'ev, L.S. and others. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Consideration is being given to results of considering correlation function (R/sub 2/) of two cumulative protons, escaping at angles, close to 90 deg with T=50-320 MeV energies. R/sub 2/ was measured in pA->ppX reaction (A-targets of C, Ti, Pb) at 3; 7.5 GeV/c momentum and in π/sup +/A-> ppX reaction at 3 GeV/c momentum. The data on narrow correlations are discussed. Consideration of multiplicity dependence on impact parameter increases R/sub 2/ value. If the length of lead tube doesn't achieve the maximal value at 3 GeV/c, the dependence on impact parameter decreases and R/sub 2/ decreases consequently. The observed relation R/sub 2/(pπ; 5 GeV/c) > R/sub 2/(pPb; 3 GeV/c) corresponds qualitatively with described picture. Nevertheless consideration of this fact doesn't enable to explain completely R/sub 2/ value on heavy nuclei. 7 refs.; 3 figs.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 5494, 5497, 5556, 5558, 5560, 5642

5415 **(BARI-TH—88-32) Transverse spin effects and resonance interference in high energy inclusive reactions.** Nardulli, G. (Bari Univ. (Italy)). [1988]. 6p. (CONF-880983—43). NTIS (US Sales Only), PC A02. Order Number DE89003209/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

Polarization for inclusively produced hyperons at high energy is computed by considering interference between different resonances. In the low p/sub T/ region a Regge model is employed for the resonance production, which produces results in agreement with experiment. At high transverse momentum the use of perturbative QCD produces too small values for the hyperon polarization. 13 refs.

5416 **(BNL—41934) Strange dibaryon production in relativistic heavy ion collisions.** Dover, C.B. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016. 20p. (CONF-8809143—3). NTIS, PC A03/MF A01. Order Number DE89003159/JAW.

From Hypernuclear and low-energy kaon physics; Padova, Italy (12 Sep 1988).

We review theoretical predictions for the mass spectrum of strange dibaryons, with emphasis on S = {minus}2 states. In a version of the Callen-Klebanov model applied to dibaryons, the lowest-lying configuration is an SU(3) flavor [10*] with J/sup π/ = O^+ and isospin I = 1, in contrast to the six-quark (Q^6) bag model, which yields the H dibaryon (flavor [1], J/sup π/ = O^+, I = O) as the lowest S = {minus}2 excitation. Possible experimental consequences of this difference level order are discussed. For the H, we discuss formation rates in relativistic heavy ion collisions. For Brookhaven AGS energies (15 GeV/A), we find a rate of order 10/sup {minus}2/ H's per central collision. Since the H is produced in a high multiplicity environment in heavy ion collisions, its detection poses a problem. Several possible detection schemes for the H are investigated. These include studies of weak decays (Σ/sup minus/p "vees"), diffractive dissociation (Hp $\rightarrow$ $\Lambda\Lambda$p $\rightarrow$ 3p + 2π/sup {minus}/) and nuclear fragments with anomalous charge/mass ratios. 40 refs., 5 figs., 2 tabs.

5417 **(BNL—41988) Hyperon polarization and multiple quark scattering.** Szwed, J.; Wit, R. (Brookhaven National Lab., Upton, NY (USA); Uniwersytet Jagiellonski, Krakow (Poland). Dept. of Physics). Oct 1988. Contract AC02-76CH00016. 7p. (CONF-880983—15). NTIS, PC A02/MF A01. Order Number DE89003573/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

The quark scattering off external gluonic field, calculated to second order, and the quark recombination model are used to describe both the Λ inclusive production cross-section and the Λ polarization. The model gives good agreement with experimental data. 15 refs., 1 fig.

5418 **(BNL—41989) Nonperturbative effects of fermions in the SU(2) sector of the standard model.** Lee, I-Hsiu. (Brookhaven National Lab., Upton, NY (USA)). Oct 1988. Contract AC02-76CH00016. 7p. (CONF-8808145—2). NTIS, PC A02/MF A01. Order Number DE89003162/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Some nonperturbative effects of fermions in the SU(2) sector of the standard model are studied on the lattice. The results from both analytic studies and numerical simulations with dynamical fermions are presented. Implications for the strongly coupled standard model are discussed. 20 refs.

5419 **(CEA-CONF—9457) Weak interactions and lattices.** Billoire, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 8p. (CONF-8803109—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755330/JAW.

From 23. Rencontre de Moriond conference: electroweak interactions and unified theories; Les Arcs, France (6 Mar 1988).

Doing Weak and Electromagnetic Interactions physics, one is unavoidably faced with non perturbative problems. Those cannot be solved using perturbative techniques. Introducing a discrete grid for space time (a lattice) allows to regularize quantum field theories without any reference to perturbation theory, and opens the possibility of a full fledged, non perturbative evaluation of functional integrals. Monte Carlo simulation allows such an evaluation, by brute force. The first part is an introduction to lattice field theories. The second part was devoted to selected applications to weak / electromagnetic physics, namely non perturbative study of the Higgs phenomena (an upper bound on the Higgs boson mass is obtained), and the evalution of operator matrix elements between hadronic states, in order to compute e.g. decay constants and form factors (both elastic and inelastic).

5420 **(CERN-EP—88-99) Critical issues and prospects for future work in photon-photon collisions.** Sens, J.C. (European Organization for Nuclear Research, Geneva (Switzerland)). 16 Aug 1988. 34p. (CONF-8804147—7). NTIS (US Sales Only), PC A03. Order Number DE89003189/JAW.

From 8. international workshop on photon-photon collisions; Shoresh, Israel (24 Apr 1988).

This paper discusses the following topics: the Higgs in electron- positron and in photon-photon collisions; photon-photon colliders; photon-photon collisions at SLC and CLIC; and lasers at the final focus. 7 refs., 9 figs., 5 tabs.

5421 **(CONF-8808145—9) Light quark spectroscopy.** Close, F.E. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1988. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01. Order Number DE89003118/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Recent data, in particular from LASS and GAMS, are beginning to give a rather clear picture of the spectroscopy of mesons composed of u, d, and s flavors. Details of the radial excitations are now appearing. It may become possible to identify gluonic or molecular and multiquark states by their failure of fit into the emerging q{bar q} spectrum. An "anti-selection rule" for gluonic hadrons is presented. 20 refs., 3 figs., 1 tab.

5422 **(FNAL/C—88/134-T) Topics in b-physics.** Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1988. Contract AC02-76CH03000. 35p. (CONF-8807130—1). NTIS, PC A03/MF A01. Order Number DE89003279/JAW.

From 4. workshop on recent developments in high energy physics; Chania-Crete, Greece (1 Jul 1988).

We discuss a few issues in the burgeoning field of physics of hadrons containing the b-quark. These include: A simple parameterization of the Kobayashi-Maskawa matrix featuring a triangle in the complex plane, a review of B/sub s/ and B/sub d/ mixing with special attention given to width-mixing and the CP-violating same-sign dilepton asymmetry, a discussion of the CP-violating decay B/sub d/ $\rightarrow$ {psi}π^+ π/sup {minus}/, and a discussion of Cp-violating rate asymmetries in the two-body decays Λ/sub b/ $\rightarrow$ pπ/sup {minus}/ and Λ/sub b/ $\rightarrow$ pK/sup {minus}/. The concluding discussion concerns generalizations beyond these specific topics. 22 refs., 6 figs.

5423 (INIS-mf—11328, pp 54) **Production and decay of supersymmetric particles.** Bartl, A.; Fraas, H.; Majerotto, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; Wuerzburg Univ. (Germany, F.R.). Physikalisches Inst.; Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5424 (INIS-mf—11328, pp 56) **Simulation of quark systems on a space-time lattice.** Eder, G.; Faber, M.; Feilmair, W.; Gerstenmayer, E.; Kamesberger, J.; Lahrmann, H.; Markum, H.; Mueller, M. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5425 (INIS-mf—11328, pp 81) **Quark polarization cloud around static quark charges.** Faber, M.; Feilmair, W.; Markum, H.; Mueller, M. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5426 (INIS-mf—11328, pp 81) **Potential model for the nucleon-antinucleon interaction.** Plessas, W.; Obersteiner, P. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5427 (INIS-mf—11328, pp 83) **Hadronic production and decay properties of charmed particles.** Rybicki, K. (Institute of Nuclear Physics, Krakow (Poland)). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5428 (INIS-mf—11328, pp 84) **Further experiments on neutron-electron scattering and the electric polarizability of the neutron.** Schmiedmayer, J.; Rauch, H.; Riehs, P. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5429 (INIS-mf—11328, pp 85) **Calculation of proton-deuteron polarization observables below the deuteron breakup.** Stadler, A.; Berthold, G.H.; Zankel, H. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5430 (INIS-mf—11328, pp 11) **Strings instead of points: new approaches to unification.** Nicolai, H. (Hamburg Univ. (Germany, F.R.). 2. Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5431 (INIS-mf—11328, pp 55) **Origin of inflation within a class of supersymmetric preon models.** Cvetic, M.; Huebsch, T.; Pati, J.C.; Stremnitzer, H. (Univ. Pennsylvania (USA); Univ. Texas (USA); Univ. Maryland (USA); Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5432 (INIS-mf—11328, pp 57) **New results in supersymmetric quantum mechanics.** Grosse, H.; Pittner, L. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik; Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5433 (INIS-mf—11328, pp 85) **Approximate calculation of potentials by inverting scattering data at several energies.** Schnizer, W.A.; Leeb, H. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5434 (INIS-SU—62/A, pp 51-53) **Spin and electroweak effects in the neutrino-electron interaction.** Kerimov, B.K.; Safin, M.Yu.; Haidar, N.; Tikhomirov, A.M. (Moskovskij Gosudarstvennyj Univ. (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The experimental data on elastic ν-bar/sub e/e/sup -/ scattering with reactor antineutrinos are also analysed. νe/sup -/ and ν-bare/sup -/ scattering are highly sensitive to values of the EM moments of neutrinos. The results obtained give following bounds on the values of neutrino EM moments: f/sub 2ν/(0), g/sub 2ν/(0) < 5x10/sup -11/. 7 refs.; 1 fig.

5435 (INIS-SU—62/A, pp 56-57) **Possible tests for supersymmetry in e/sup +/e/sup -/ collisions with polarized beams.** Bilenky, S.M.; Nedelcheva, N.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

General relations between polarization characteristics of the processes of supersymmetric particle production in polarized e/sup +/e/sup -/ collisions which reflect only the chiral properties of the Lagrangian of N=1 supersymmetry and do not depend on the parameters determined by the mechanism of supersymmetry breaking are presented. The production of scalar leptons μ-tilde/sub L//sup +/ and μ-tilde/sub L//sup -/(μ-tilde/sub R//sup +/ and μ-tilde/sub R//sup -/) or tau-tilde/sub L//sup +/ and tau-tilde/sub L//sup -/ and tau-tilde/sub L//sup -/ (tau-tilde/sub R//sup +/ and tau-tilde/sub L//sup -/) scalar neutrinos ν-tilde/sub l/ and ν-tilde/sub l/ (l=e, μ, tau...), a pair of winos W-tilde/sup +/ and W/sup -/tilde/sup -/ or charged higgsinos is considered. 4 refs.

5436 (INIS-SU—62/A, pp 60-61) **Anomalous trilinear couplings of gauge bosons at colliding beams.** Larin, V.N.; Tikhonin, F.F. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The process e/sup +/e/sup -/ -> γ+ν/sub i/ν-tilde/sub i/ has been considered to check the coupling for W/sup +-/,Z/sup 0/ bosons and γ and to check the validity of the gauge approach. The cross sections has been calculated. The influence of natural transverse polarization of the beams on the process was studied. 3 refs.; 1 fig.

5437 (INIS-SU—62/A, pp 39-41) **Predictions from the quark-parton model and source theory for deep-inelastic scattering with polarized particles.** Garavaglia, T. (Dublin Inst. for Advanced Studies (Ireland)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The purpose of the article to describe the difference between quark-parton model and source theory for deep inelastic scattering with polarized particles and to suggest how these two different descriptions of hadronic dynamics may be distinguished experimentally. The asymmetry parameter is defined from the differential cross sections of deep inelastic scattering of leptons and hadrons with parallel and antiparallel orientation of the spin polarization. The structure function is determined. 9 refs.

5438 (INIS-SU—62/A, pp 58-59) **Electromagnetic effects of hadrons in deep inelastic scattering of polarized leptons by polarized nucleons.** Shumejko, N.M.; Timoshin, S.I. (Belorusskij Gosudarstvennyj Univ., Minsk). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A numerical analysis of hadronic electromagnetic corrections (EC) {similar←to}2{vert←bar}in the deep inelastic scattering (DIS) cross section {similar←to}α/sup 3/ has been performed. Numerical calculations of the corrections have been carried out for μ/sup +-/p DIS at the lepton energy E=200 and 500 GeV. The quark mass M changes within the limits 0.33-1.0 GeV. 5 refs.

5439 (INIS-SU—62/A, pp 20-23) **Hyperon polarization in inclusive production processes: massive quark polarization in QCD subprocesses.** Dharmaratna, W.D.; Goldstein, G.R.; Ringland, G.A. (Tufts Univ., Medford, MA (USA); Rutherford Appleton Lab., Chilton (UK)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The fourth order contributions to massive quark polarization inquark-quark and quark-gluon scattering has been calculated. A comparison is made with the Szwed-Mott scattering limit. The relation to polarized hyperon production is explored. 5 refs.

5440 (INIS-SU—62/A, pp 28-29) **Polarization in charge exchange reactions.** Jenkovszky, L.L.; Struminsky, B.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A series of brilliant experiments on exclusive charge exchange reactions has recently been performed in Serpukhov. A unique set of polarization data on π/sup -/p going to π/sup 0/n, A/sub 2/n, fn, etan, eta'n and ωN at a record energy (40 GeV/c) and statistics (3 million events for π/sup -/p -> π/sup 0/n with squared momentum transfers spanning up to 3 GeV/sup 2/ have been collected. It is necessary to fit the results to data in phenomenological models, to find relations between different reactions and to explain the observed phenomena. 5 refs.

5441 (INIS-SU—62/A, pp 30-31) **Odderon exchange and polarization at hygh energy.** Levin, E.M.; Ryskin, M.G. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Odderon exchange is evaluated in the framework of perturbative QCD. In leading log approximation the properties of the odderon has been studied. With α/sub s/ accuracy the odderon is a three gluon exchange (α/sub s/-coupling constant). In the simplest quark model the relative magnitude of odderon spin flip is almost the same as for pomeron exchange. 2 refs.

5442 (INIS-SU—62/A, pp 42-44) **Orbital angular momentum and the parton model.** Ratchliffe, P.G. (Queen Mary Coll., London (UK)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The hadron-hadron scattering is considered in the framework of parton model. The hard scattering processes involving the parton via QCD and/or QED and distributions of the partons as hadronic constituents is studied. Orbital angular momentum of hadron is summed over all quark types. 3 refs.

5443 (INIS-SU—62/A, pp 45-48) **Chi/sub c/-charmonium - a tool to investigate gluon polarization.** Batunin, A.V.; Slabospitskij, S.R. 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

In the present paper it is shown that the measuring of angular distributions of the decay production of chi/sub c/ charmonium states seems to be a splendid tool in the investigation of gluon polarization. This is connected with the fact that chi/sub c/-production is mainly the result of gluon interaction from the initial hadrons, unlike the lepton pairs hadroproduction. The angular distributions obtained for leptons and proton from the decay of chi/sub c/-meson is presented in table. The carried out analysis of chi/sub c/-meson production, as a result of fermion annihilation, may be applied to the resonance production of chi/sub c/-meson in pp-annihilation. 3 refs.; 1 fig.; 1 tab.

5444 (INIS-SU—62/A, pp 49-50) **Test of the sea quark polarization.** Richter-Was, E.; Szwed, J. (Uniwersytet Jagiellonski, Krakow (Poland)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The spin-spin asymmetry in the Drell-Yan process with longitudinally polarized protons in both beam and target is discussed including Z/sub 0/ effects and considered as a test of the sea quarks polarizaion. Numerical calculations are made for models with polarized and unpolarized sea. 2 refs.; 2 figs.

5445 (INIS-SU—62/A, pp 54-55) **Relativistic effect of spin rotation at the description of two-body systems.** Troitsky, V.E. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Under assumption that together with a weak interaction in the framework of Glashow-Wienberg-Salam standard model of electroweak interaction there exists electromagnetic (EM) interaction between neutrino and electron, the next expressions for differential cross sections of the reactions $\nu(\nu\text{-bar})+e/sup\ -/ \rightarrow \nu(\nu\text{-bar})+e/sup\ -/(\nu=\nu/sub\ e/, \nu/sub\ tau/, \nu/sub\ \mu/)$ have been obtained. The electromagnetic structure of a system of two spin 1/2 particles in the S-state of relative motion is considered. The relativistic spin rotation effect increases with increasing Q/sup 2/, where Q is momentum transfer. 2 refs.

5446 (INIS-SU—62/A, pp 78-82) **Spin effects as a manifestation of confined quarks.** Lednicky, R. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The results on vector meson spin alignment are compared with other polarization data and discussed in terms of the quark-parton model incorporating the spin-orbit interaction with the confining field. Some problems of the model are considered; predictions are given. 13 refs.

5447 (INIS-SU—62/A, pp 102-104) **Analysis of the energy dependence of pp-scattering polarization parameters in the energy range 0.8-1.0 GeV.** Vovchenko, V.G.; Efimovykh, V.A.; Zhdanov, A.A. and others. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The phase shift analysis (PSA) is a main method for the pp-scattering matrix reconstruction at the energy above 0.6 GeV. Measurements of the parameters K/sub noon/(D/sub nono/), A/sub oonn/ and the asymmetry(polarization)A/sub ooon/ were carried out in LNPI in the energy range 0.8-1.0 GeV and allowed to perform PSA at 0.8, 0.85, 0.90 and 0.97 GeV. PSA at 0.8 and 0.97 were performed for checking the solutions obtained earlier. The total cross sections: σsub tot/, Δ4v/sub T/, the differential cross section d/sub $\sigma(\Theta$, correlation meters A/sub ookk/(Θ,A/sub oosk/(Θ and the results of our measurements of the parameters A/sub ooon/(Θ, A/sub oonn/(Θ, K/sub noon/(Θ, D/sub nono/(Θ were employed in PSA at 0.85 and 0.90 GeV. The polarizaion parameters were measured in general in the angular interval (40 deg-90 deg) c.m.s. Only the different cross section was measured at small angles. PSA at 0.85 and 0.90 GeV were carried out for the first time. 6 refs.; 3 figs.

5448 (INIS-SU—62/A, pp 142-145) **Prediction of the / sup 1/p/sub 1/ NN phase shift based on the diquark cluster model.** Noya, H.; Konno, N.; Nakamura, H. (Hosei Univ., Tokyo (Japan); Aoyama Gakuin Univ., Tokyo (Japan)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The /sup 1/P/sub 1/ NN phase shift is predicted based on the diquark cluster model. Three distinct state groupings of the / sup 1/P/sub 1/2/ dibaryons with I=0 and J/sup P/=1/sup -/ where the /sup 1/P/sub 1/ NN phase shift in the range 2.1-2.3 GeV c.m. energy is most likely found are presented. The Argand diagram of the NN T-matrix with I=0, J/sup P//sub 1//sup -/ as a function of c.m. energy E is shown. 3 refs.; 1 fig.

5449 (INIS-SU—62/A, pp 210-212) **Note on polarization of p-bar beams.** Peaslee, D.C. (Michigan Univ., Ann Arbor (USA); Maryland Univ., College Park (USA)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

A polarized hydrogen target and P/sub L/=0.5 GeV/c to capitalize on the S(1936) effect is considered. The latest measurements, suggest a maximum Δ4d/$\delta$of order 1% for pp collisions in this region - assuming that the S(1936) reflects underlying resonance structure in a specific spin state. Higher momentum regime for the filter, P/sub L/ {similar←to}1.5 to 3.1 GeV/c is proposed in an attempt to take advantage of more peripherial reactions: namely, p-barp -> Δbarp + p-barΔ p-barp -> ΔbarΔ The threshold for the second reaction is around 2.3 GeV/c, above which it is expected to dominate. Not only should absorption be increased by these reactions, but also p-barp scattering through the two-stage reaction pp-bar -> (Δbarp, p-barΔ ΔbarΔ -> p-barp. 6 refs.

5450 **(NBI-HE—88-59) On electroweak magnetism.** Ambjoern, J.; Olesen, P. (Niels Bohr Inst., Copenhagen (Denmark)). Sep 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755695/JAW.

The vacuum of the electroweak theory becomes unstable when a homogeneous magnetic field exceeds m/sub w//sup 2//e. Using Bogomol'nyi's method (requiring that the Higgs mass equals the Z mass) we find a static magnetic solution of the classical electroweak equations which is valid above m/sub w//sup 2//e. This solution corresponds to a vacuum condensate of W and Z bosons. The condensate anti-screens the magnetic field by means of the charged W-current.

5451 **(OUP—88-17) Role of penguin-like interactions in weak processes.** Eeg, J.O. (Oslo Univ. (Norway). Fysisk Inst.). Oct 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755674/JAW.

Basic properties of penguin diagrams are reviewed. Some model dependent calculations of low momentum penguin loop contributions are presented. CP-violating effects generated when penguin-like diagrams are inserted in higher loops are described. 78 refs.

5452 **(RAL—88-076) Top quark in the standard model and a little way beyond.** Phillips, R.J.N. (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756028/JAW.

The role of the top quark is briefly reviewed, mentioning (1) arguments for its existence, (2) experimental signatures, (3) constraints from existing data in the Standard Model and (4) the implications of some small excursions beyond. (Mini-rapporteur talk at the XXIV International Conference on High Energy Physics, Munich, August 1988).

5453 **(SLAC-PUB—4711) Staggering towards a calculation of weak amplitudes.** Sharpe, S.R. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 19p. (CONF-8804219—1). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002389/JAW.

From Ringberg workshop on hadronic matrix elements and weak decays; Ringberg Castle, F.R. Germany (18 Apr 1988).

An explanation is given of the methods required to calculate hadronic matrix elements of the weak Hamiltonians using lattice QCD with staggered fermions. New results are presented for the 1-loop perturbative mixing of the weak interaction operators. New numerical techniques designed for staggered fermions are described. A preliminary result for the kaon B parameter is presented. 24 refs., 3 figs.

5454 **(SLAC-PUB—4726) The electroweak polarization asymmetry: A guided tour.** Kennedy, D.C. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 19p. (CONF-880983—11). NTIS, PC A03/MF A01. Order Number DE89002842/JAW.

From 8. international symposium on high energy spin physics; Minneapolis, MN, USA (12 Sep 1988).

A comprehensive review is provided of the electroweak polarization asymmetry at the Z^0, a highly accurate measure of the Z^0 coupling to fermions. Its significance as a precision test of the Standard Model is explored in detail. Emphasized are the role of electroweak symmetry-breaking and radiative corrections; the non-decoupling of new physics beyond the Z^0; and the testing of extensions of the Standard Model, such as supersymmetry, technicolor, new generations of fermions, grand unification, and new gauge forces. Also discussed are the relationship of the polarization asymmetry to other electroweak observables and its superiority to other Z^0 asymmetries. Experimental issues are briefly presented, stressing the importance of polarization at the SLC and LEP e^+e^- colliders. 42 refs., 13 figs., 2 tabs.

5455 **(SLAC-PUB—4747) Limits on a lepton number violating process in e^+e^- collisions.** Gan, K.K. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Oct 1988. Contract AC03-76SF00515. 4p. (CONF-8808145—6). NTIS, PC A02/MF A01. Order Number DE89002839/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

If a new hypothetical particle induces a lepton number violating process, it could also affect $e^+e^- \rightarrow \mu^+\mu^-$ and {tau}$^+${tau}$^-$ through its t-channel exchange. A fit of the measured cross sections and forward-backward asymmetries at PEP and PETRA yields the 90% CL limits on the coupling of the particle: G/sub eμ/ < 0.119G/sub F/ and G/sub eτ/ < 0.085G/sub F/, where G/sub F/ is the Fermi coupling constant. These limits exclude certain regions of couplings allowed by other lepton number violation searches. 6 refs., 2 figs., 1 tab.

5456 **On the existence of quantum electrodynamics.** Kogut, J.B.; Dagotto, E.; Kocic, A. (Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801). *Physical Review Letters;* **61**: No. 21, 2416-2419(21 Nov 1988).

We explain from an intuitive renormalization-group perspective how "collapse of the wave function" in quenched quantum electrodynamics leads to coupling-constant renormalization and an interacting ultraviolet stable fixed point. A diagrammatic expansion in N/sub f/, the number of fermion species, suggests that vacuum polarization leaves the fixed point of the quenched model stable, and computer-simulation data support this possibility. The scaling region of the quenched lattice model is discovered numerically.

5457 **Spontaneous lepton-number breaking at electroweak scale.** Chang, D.; Keung, W.; Pal, P.B. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60201). *Physical Review Letters;* **61**: No. 21, 2420-2423(21 Nov 1988).

We propose some new models with spontaneous lepton-number breaking where the nuetrino masses and the couplings of the Goldstone boson (majoron) to charged fermions are naturally small because they arise in quantum loops. Thus, unlike other majoron models, we do not have to invoke any new scale in the model which is very different from the electroweak scale.

5458 **Canonical quantization of the interacting CP^1 nonlinear σ model with the Chern-Simons term.** Panigrahi, P.K.; Roy, S.; Scherer, W. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review [Section] D: Particles and Fields;* **38**: No. 10, 3199-3204(15 Nov 1988).

The (2+1)-dimensional interacting CP^1 nonlinear σ model with the Chern-Simons term is canonically quantized. In the process we establish the connection between fractional spin and the rotational anomaly. The current algebra of the system has also been analyzed. It admits a central extension.

5459 **Limits on an electromagnetic fifth force.** Bartlett, D.F.; Loegl, S. (Department of Physics, University of Colorado, Boulder, Colorado 80309). *Physical Review Letters;* **61**: No. 20, 2285-2287(14 Nov 1988).

In analogy to the proposed gravitational "fifth" force, limits can be set on the range λ and the strength β of an electrical fifth force. Specifically we consider the potential V = (e^2/r)(1+βe/sup -r///sup λ/) and show that there is a region near λ = 1 μm where existing experiments set relatively poor limits on β.

5460 (JINR—D-1,2-86-668-Vol.1, pp 35-50) **Extended skyrme model and Wess-Zumino terms from quark flavour dynamics.** Ebert, D.; Reinhardt, H. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik; Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The effective chiral meson lagrangian obtained by path-integral bosonization of an extended NIL (Nambu-Iona-Lainsinio) model of quark flavour dynamics is presented. Physical content is investigated. The obtained lagrangian contains not only the common kinetic and interaction terms but also quartic derivative terms of the Skyrme-type as well as the gauge Wess-Zumino term. The consequencies of the arising new quartic derivative terms for meson physics as well as for the problem of the skyrmion stability and the N-N potential are reviewed. 37 refs.; 1 figs.; 2 tabs.

5461 (JINR—D-1,2-86-668-Vol.1, pp 51-62) **QCD, confinement and low-energy hadron physics.** Efimov, G.V.; Ivanov, M.A. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The problem to what extent the concept that quark propagator in the confinement range is a whole function in the p/sup 2/-plane agrees with QCD, is discussed. Gluon propagator at high distances, vacuum in QCD, model of interacting electromagnetic field, fermion in a field with constant magnetic and electric intensity, are considered. The discussion performed proves that quark discussion in the confinement range by the whole function in a momentum space does not contradict at least QCD within strong interaction at high distances. 11 refs.

5462 (JINR—D-1,2-86-668-Vol.1, pp 63-68) **Mass of constituent quarks, vector and pseudoscalar mesons in quark model of superconducting type.** Volkov, M.K. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

A model with a four-quark interaction of a superconducting type is considered. The model permits to reproduce practically all earlier known phenomenologic meson lagrangians on a uniform basis, but with a much lower number of arbitrary parameters and to describe the most important low-energy processes with meson participation (meson decay, scattering lengths, radii and polarization). The formulae describing masses of vector and pseudoscalar mesons are obtained. Registering masses of s-quark according to mass difference of phi and rho-mesons it is possible determine precisely both masses of K mesons and those of pseudoscalar K-mesons. Recording mass difference of u- and d-quarks according to decay width W -> 2π it is possible to describe mass difference of K/sup 0/ and K/sup +-/ mesons. the description of low-energy physics of 0/sup -+/ and 1/sup --/ within the framework of the above model. 9 refs.

5463 (JINR—D-1,2-86-668-Vol.1, pp 89-104) **Modified Skyrme model and baryon-baryon interaction.** Otofuji, T.; Saito, S.; Yasuno, M.; Kurihara, T.; Kanada, H. (Nagoya Univ. (Japan). Dept. of Physics; Niigata Univ. (Japan). Dept. of Physics). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The baryon properties and the skyrmeon-skyrmeon (SS) interaction is investigated within the frame of constants in the model are taken as well as possible within the experimental data of the $\pi\pi$ scattering. Two kinds of gate the contribution of the new destabilizer L/sub 4s/ (the symmetric quartic terms). The case that the L/sub 4s/ terms is not included to make clear the role of the term is also invetigated. It is shown that the calculated SS interaction potential is projected onto the NN, NΔand Δ4D channels by using and tensor decomposition technique in the spin-isospin space SO(4) and is classified by the asymptotic behaviours. This decomposition is convenient to discuss what ingradients are involved in the potential. It is pointed out that the additive ansatz for the ω-field which is used in the study of SS interaction by the explicit inclusion of the ω-coupling terms is not correct when one calculatesa the SS interaction potential in the short range. The calculation of the phase shift in the proton-proton scattering by using the obtained SS interaction is also shown. 21 refs.; 5 figs.; 1 tab.

5464 (JINR—D-1,2-86-668-Vol.1, pp 120-142) **Towards relativistic electromagnetic baryon couplings motivated by QCD.** Schroeder, H.; Pfeil, W.; Rollnik, H. (Bonn Univ. (Germany, F.R.). Inst. fuer Physikalische Chemie). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The electromagnetic properties of nonstrange baryons are discussed. The general theoretical ideas which lead to a quasi-relativistic interaction Hamiltonian between quarks and the electromagnetic fields expressed in a formal series in powers of 1/c are explained. Explicit formula for the (1/c)/sup 2/ and (1/c)/sup 3/-terms is given. Application of these results to the Isgur-Karl model for baryons is discussed. The theoretical findings are compared with the experimental helicity amplitudes for the photoexcitations of baryon resonances and their dependence on the momentum transfer. 31 refs.; 8 figs.

5465 (JINR—D-1,2-86-668-Vol.1, pp 143-151) **Problem of light meson radial excitations and iota meson interpretation.** Gerasimov, S.B.; Govorkov, A.B. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The work is aimed at discussing lower multiplets of radial excited states of light vector and pseudoscalar mesons. The authors follow an earlier developed scheme of phenomenologic analysis of radial excitations of qq-bar-systems (with orbital moment L=0). The conclusion is made that an adequate interpretation of pseudoscalar resonances largerly depends on solution of a number of problems connected with the general establishment of mass spectrum and other properties of radial excitations of light mesons. Presently known J/sup PC/=0/sup +-/ isosinglet (I/sup 6/=O/sup +/) resonances are presented. A share of decay of J/psi meson to form the assigned meson; the ratio of cross sections of production of the given meson and eta-meson in π/sup -/p reaction; width of two-photon decay of the given meson are presented. No significant mixing of pseudoscalar glueball with radial excitations of qq-states is supposed. The comparison of results obtained with the experiment will permit to estimate the degree of necessity of including new (gluon or multiquark) degrees of freedom to describe the picture observed. 18 refs.; 4 tabs.

5466 (JINR—D-1,2-86-668-Vol.1, pp 152-161) **Sum rules for heavy quarkonia without operator expansion.** Shuryak, E.V.; Zhirov, O.V. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

In this work it is discussed whether the data on e/sup +/e/sup -/ -> bb-bar indicate the presence of Coulomb-type potential between b quarks at small distances and some estimates of its strength are obtained. The main results of investigations of sum rules for upsilon system is that, unlike for all other known hadrons, there exist a possibility to consider the large to be affected by nonperturbative effects, not too small for nonrelativistic approach to be meaningless. Available data fix the total energy of such packet with the accuracy of the order 0.1 GeV. This observation put important but only constraint on both the quark mass and magnitude of Coulomb-type potential. Unfortunately, experimental and theoretical uncertainties are too large to fix each of them independently. With better data and account for relativistic corrections it will be possible to extend the "window" and make better fit, fixing not only the absolute magnitude of logarithmic derivative in it, but its slope too. Only this way may allow to obtain stronger restrictions on parameters under investigation. 16 refs.; 6 figs.

5467 (JINR—D-1,2-86-668-Vol.1, pp 162-170) **Toponium.** Dremin, I.M. (AN SSSR, Moscow. Fizicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The prospects of detecting new phenomena when penetrating a new range of small distances (of the order of 0.1 fm or less) are discussed. Experimental data available prove that toponium is in the range from 60 to 100 GeV. In the case of toponium new possibilities of checking-up QCD forecasts inaccessible for charmonium and bottomonium appear. Possible directions for research apart from purely spectroscopic are discussed. They are the problems of the weak interaction theory-interference with neutral intermediate boson, role of weak decay of top-quark, as well as the production of Higg's boson and supersymmetric partners of conventional particles. 6 refs.

5468 (JINR—D-1,2-86-668-Vol.1, pp 171-181) **Exotic meson problem.** Achasov, N.N. (AN SSSR, Novosibirsk. Inst. Matematiki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The problem of exotic mesons-four-quark q/sup 2/q-bar/sup 2/-states, qqq-hybrides, gg glueballs etc is discussed. Scalar mesons, exotic resonance production with I=2, J/sup p/=2/sup +/ m(E) ≅1.4 GeV in γγ -> rhorho reaction are considered. The problem is set whether the resonance in π/sup 0phi/-channel is a q/sup 2/q-bar/sup 2/-signal. What is (1700)-meson and is i (1460) resonance a glueball. The exotic nature of scalar G(1590) resonances is discussed. A number of experiments which are necessary for radical advance in the understanding of exotic meson problem are suggested. 28 refs.

5469 (JINR—D-1,2-86-668-Vol.1, pp 182-191) **Heavy quarkonium as test particle of QCD-vacuum and hadronic structure.** Bajer, V.N.; Pinelis, Yu.F. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

A consecutive viewpoint on how the research of quarkonium internal dynamics (of heavy quark and antiquark QQ-bar) permits to obtain information on fundamental QCD-parameters; to understand from QCD-parameters the status of phenomenologic potential models and constituent quark model, is given. Coulomb effects and Δsub M-barS-bar/, relativistic effects in Coulomb sum rules, vacuum structure, condensates, field correlators, vacuum effects for QQ-bar systems, QCD and potential models are considered. 31 refs.; 5 figs.

5470 (JINR—D-1,2-86-668-Vol.1, pp 192-199) **E2/M1 ratio of electromagnetic Nreversible Δ1232) transitions as a measure of tensor forces between quarks.** Weber, H.J. (Virginia Univ., Charlottesville (USA). Dept. of Physics). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The ratio of electric quadrupole to magnetic dipole ΔN transition amplitudes in the process γN -> Δ1232 -> πN is known to be sensitive to the tensor forces between quarks. In the basis of three-quark baryon wave functions and N and Δwave function component the color hyperfine interaction and one-pion exchange are diagonalized, thus the N and Δadmixture coefficients are determined. 13 refs.; 1 fig.; 1 tab.

5471 (JINR—D-1,2-86-668-Vol.1, pp 200-206) **Rare processes in hadron production of heavy quarks.** Kiselev, V.V.; Likhoded, A.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Hadron charm and beauty particles production is reviewed. the greatest progress in studying charm and beauty is connected with e/sup +/e/sup -/-annihilation in hadrons. QCD predictions are most vividly realized when considering hadron production of concealed charm and beauty particles and especially in pair production of J/psi particles. Pair production of psi particles can be a unique experimental method of separating heavy glueballs. The other rare process in the production of particles with heavy quarks pertains to the production of mesons of mixed aroma. Hadron production of Bc (bc-bar/sub -/mesons are used as an example. Unlike the charm production Bc must not be produced with B-barc. A continuum contribution in the bc system with the production of associated (B/sub 4,d/+D)-mesons which can be an order higher than the contribution of resonance states in this system is possible. It can be expected that the cross section of inclusive Bc-meson production will be of the order of 1 nb. At higher energies this cross section will also grow at the expense of contribution of gluon annihilation. Preliminary estimates show that cross section of production of baryons with binary charm CCq are at the level of 10 nb. 11 refs.; 4 figs.

5472 (JINR—D-1,2-86-668-Vol.1, pp 207-211) **Self-consistent quark model of nonstrange baryons.** Barts, B.I.; Inopin, A.E.; Inopin, E.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The possibility of plotting a self-consistent model for a three-quark system interacting by one of the modern variants of quark-quark potential is studied. The consideration is done in nonrelativistic approximation. The idea of quark motion in a certain self-consistent field permits to give a good description of the main characteristics of nonstrange baryon. A developed approach can be used to describe multiquark system. 5 refs.; 2 figs.

5473 (JINR—D-1,2-86-668-Vol.1, pp 212-221) **Pion degrees of freedom in nonrelativistic quark model.** Kvitsinskij, A.A.; Kuperin, Yu.A.; Merkur'ev, S.P.; Yarevskij, E.A. (Leningradskij Gosudarstvennyj Univ. (USSR)). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Within the framework of standard lagrangian of pion-quark interaction an effective adiabatic approximation to solve dynamic equations is plotted. On the basis of this technique a potential one-pion exchange in hybrid quark model is plotted and its contribution in the static characteristics of baryons is analysed. Analysis results show that the described modification of non-relativistic quark model (NRQM) with massless allows one to describe the hadron static properties in the three-particle sector more adequately. At the same time the remaining deviation from experimental data may be partially conditioned by initial approximation - pion masslessness. Confidence is expressed that refusing this approximation and accounting exchanges by heavier mesons will reduce the number of defects which are usually associated with original WRQM version. 9 refs.; 5 figs.; 2 tabs.

5474 (JINR—D-1,2-86-668-Vol.1, pp 227-237) **Phase transition of deconfinement near continual limit of lattice QCD.** Mogilevskij, O.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The effects of lattice limit particular in lattice QCD-thermodynamics are studied and deconfinement phase transition is considered. Only gluon QCD sector is considered. Dynamic quarks are not discussed. The SU(2) group is considered as a calibration group. The conclusion is made that parameterization of nonperturbative contribution in calibration system statistical sum in the form of linear function on temperature permits to describe the totality of Monte-Carlo data for thermodynamic functions. In this case the value of vacuum pressure B(T) in the range 50 < T/λsub L/ < 150 (where λsub L/ - lattice parameter {similar←to}5 MeV for SU(2) group) varies within 180 MeV < B/sup 1/4/ (T) < 250 MeV. Such values of vacuum pressure B are chosen in different versions of the model of bags to describe deconfinement phase transition. 16 refs.; 4 figs.; 1 tab.

5475 (JINR—D-1,2-86-668-Vol.1, pp 302-317) **Four-dimensional jets as universal characteristics of multiple particle production in soft and hard interactions.** Baldin, A.M.; Batyunya, B.V.; Didenko, L.A. and others. 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Results of the study of hadron jet production by the new method in various processes (pp, p-barp, π/sup -/p, π/sup -/c, pC, pTa and ν-barN) over a wide energy range from 6 to 205 GeV/c are presented. The new method is described multipole particle processes, which employ only Lorentz-invariant quantities and is devoted to the study of relativistic nuclear collisions. the main results of this analysis is the discovery of the fact that the four dimensional hadron jets are universal. 17 refs.; 8 figs.; 6 tabs.

5476 (JINR—D-1,2-86-668-Vol.1, pp 326-333) **Production of deuterons in hA collisions at high energies in the target fragmentation region.** Braun, M.A.; Vechernin, V.V. (Leningradskij Gosudarstvennyj Univ. (USSR)). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The production of relativistic deuterons in the target fragmentation region is studied. It is shown that for fast deuterons the role of the nuclear field is small and is not determined by the Butler-Pearson formulae. The main contribution comes from the direct coalescence into the deuteron of nucleons produced either at one point in the nucleus or at two different points. In the forward hemisphere for purely geometrical reasons the production at two points dominates, whereas in the backward hemisphere (the "cumulative region") the production at one point and at two different points may give contributions of the same order. 14 refs.; 7 figs.

5477 (JINR—D-1,2-86-668-Vol.1, pp 352-363) **Form factors and quark structure of lightest nuclei.** Burov, V.V.; Luk'yanov, V.K.; Dostovalov, V.N.; Martines, R. (Joint Inst. for Nuclear Research, Dubna (USSR); Dal'nevostochnyj Gosudarstvennyj Univ., Vladivostok (USSR); Gavanskij Univ.). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Form factors of deuteron, /sup 3/He, /sup 3/He and /sup 4/He were considered with regard to meson and quark degrees of freedom. It was concluded. that form factors of the highest nuclei couldn't be explained in all range of measure transfered momenta only due to NN-forces. Inclusion of meson exchange currents improves the agreement with experiment at q/sup 2/ < 75 fm/sup -2/ average transfered momenta for deuteron. The assumption of multiquark system existence in nuclei enables to explain experimental data in all measurement region. Interference of nucleon and six-quark channels in weakly bound system-deuteron is negligible. Interference in strongly bound /sup 3/H, /sup 3/He, /sup 4/He nuclei plays a dictating role in experiment explanation. 40 refs.; 11 figs.

5478 (JINR—D-1,2-86-668-Vol.1, pp 364-373) **Electromagnetic structure of some compound hadron system.** Troitskij, V.E.; Trubnikov, S.V.; Romanov, V.A. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki; Khar'kovskij Gosudarstvennyj Univ. (Ukrainian SSR)). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Electromagnetic form factors and various static characteristics of compound hadron systems - deuteron, the lightest nuclei / sup 6/Li, /sup 7/Li, /sup 7/Be; λhyperon and neutron - are considered from the common viewpoint on the basis of relativistic approach. New results for deuteron, hadron (λn) and nuclear (/sup 6/ Li, /sup 7/Li and /sup 7/Be) systems are presented. It is concluded, that "experimental" values of magnetic neutron form factor G/ sub Mn/ depend sufficiently on the choice of deuteron model, especially on the weight of D-wave, and this dependence grows qith Q/sup 2/ increase. The dependence of G/sub Mn/ on G/sub In/ choice is also important and becomes more pronounced with G/sup 2/ growth. All calculated G/sub Mn/ values deviate from the scale law at all Q/sup 2/ <or approx. 1 (GeV/c)/sup 2/. Reliable determination of G/sub Mn/ experimental values. 26 refs.; 7 figs.

5479 (JINR—D-1,2-86-668-Vol.1, pp 379-388) **Off-shell property of the NN interaction in the six-quark resonating group model.** Schmid, E.W. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The off-shell property of the NN interaction in the quark resonating-group model in the region of strogly overlapping quark clusters and not in the region of meson exchange are determined. Two problems are arized: the nonorthogonality of channel spaces, the unitarity transformations ambiguity of function bases. The conclusion is made, that the quark resonating-group model in its present form predicts the off-shell property of the NN interaction at very short distances. This off-shell property is charaterized by a repulsive soft core. Single channel results and coupled channel results agree with each other after orthogonalization of channel spaces. the unitarity transformations aither introduce three-body forces of of unacceptable strength or they have only minor effect on the nuclear wave function. 16 refs.; 7 figs.

5480 (JINR—D-1,2-86-668-Vol.1, pp 419-429) **Study on the structure of multiquark systems in the method of hyperspherical functions.** Burov, V.V.; Shitikova, K.V. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

A method is proposed, allowing one to clarify quark-quark potential parameters in non-relativistic quark model. Hyperspherical function method, in which instead of a free parameter - oscillator radius, a collective variable rho exists and as a result of this a self-tuning quark system is formed in which q-q interaction parameters define the system dimensions. A conclusion is drown that based on the method proposed it is possible to describe N-Δmass difference, mean-square nucleon radius, elastic eN-scattering formfactor. Excitation energies and densities for the basic and monopole-excited nucleon states are found. It is shown that spin-spin potential W/sup s/ (ξ enclosure changes sufficiently the effective potential W(ξ (core and depth) i.e. W/sup S/(ξ enters W(ξ non-additionally. 14 refs.; 4 figs.; 3 tabs.

5481 **Superclusters and hadronic multiplicity distributions.** Shih, C.C.; Carruthers, P. (Dept. of Physics and Astronomy, Univ. of Tennessee, Knoxville, TN (US)). pp 645-652 of Proceedings of the XVII international symposium on multiparticle dynamics. Markytan, M.; Majerotto, W.; MacNaughton, J. Teaneck, NJ; World Scientific Pub. Co. (1987). (CONF-8606203—).

From 17. international symposium on multiparticle dynamics; Seewinkel, Austria (13 Jun 1986).

The authors express the multiplicity distribution in terms of supercluster production in hadronic processes at high energy. This process creates unstable clusters at intermediate stages and hadrons in the final stage. It includes Poisson-transform distributions (with the partially coherent distribution as a special case) and is very flexible for phenomenological analyses. The associated Koba, Nielson, and Olesen limit and the behavior of cumulant moments are analyzed in detail for finite and/or infinite cluster size and particle size per cluster. The authors demonstrate that in general a supercluster distribution does not need to be equivalent to a negative binomial distribution to fit experimental data well. Furthermore, the requirement of such equivalence leads to many solutions, in which the average size of the cluster is not logarithmic: e.g., it may show a power behavior instead.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 5364, 5492, 5494, 5497

5482 **(NBI-HE—88-60) Symmetry breaking in gauge glasses.** Hansen, K. (Niels Bohr Inst., Copenhagen (Denmark)). Sep 1988. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755696/JAW.

In order to explain why nature selects the gauge groups of the Standard Model, Brene and Nielsen have proposed a way to break gauge symmetry which does not rely on the existence of a Higgs field. The observed gauge groups will in this scheme appear as the only surviving ones when this mechanism is applied to a random selection of gauge groups. The essential assumption is a discrete space-time with random couplings. Some working assumptions were made for computational reasons of which the most important is that quantum fluctuations were neclected. This work presents an example which under the same conditions show that a much wider class of groups than predicted by Brene and Nielsen will be broken. In particular no possible Standard Model Group survives unbroken. Numerical calculations support the analytical result.

5483 **Topological approach to Weyl and super-Weyl anomalies in string theory.** Louis, J.; Ovrut, B.A.; Rama, S.K. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396). *Physical Review [Section] D: Particles and Fields;* **38**: No. 10, 3094-3104(15 Nov 1988).

Cohomological methods are used to determine the functional form of the Weyl and super-Weyl anomalies in the bosonic and heterotic strings. The Wess-Zumino terms associated with these anomalies are calculated. The super-Weyl anomaly is discussed within the context of the (1,0) superspace formalism.

5484 **Electromagnetic structure of the pion and the kaon.** Bernard, V.; Meissner, U. (Center for Theoretical Physics, Laboratory for Nuclear Science Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **61**: No. 20, 2296-2299(14 Nov 1988).

We study the electromagnetic structure of the pseudoscalar Goldstone bosons (π,K) in the framework of a generalized SU(3)/ sub f/ Nambu—Jona-Lasinio model. Including vector-meson contributions beyond the Hartree-Fock approximation the q^2 dependence of the electromagnetic form factors in the spacelike region is well reproduced. We also find that $<r/\text{sub } K//\text{sub } =/^2><<r/\text{sub } \pi//\text{sub } =/^2>$, in agreement with the data.

5485 (JINR—D-1,2-86-668-Vol.1, pp 238-242) **Internal symmetry groups and their realization in Minkowski space.** Beshtoev, Kh.M. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Possibility of realizing U(1)-theory in Mikowski space is discussed. It is concluded that as much as possible Abelian U(1) subgroups can exist in four-dimensional space, where Poincare group is realized. Possible realizations of non-Abelian SU(N)-theory in Minkowski space and supersymmetry in Minkowski space are considered. 8 refs.

6454 Field Theory

REFER ALSO TO CITATION(S) 5331, 5451, 5483, 5554, 5642

5486 (INIS-mf—11328, pp 80) **Dynamic generation of gauge bosons of hidden local symmetries in non-linear sigma models.** Lucha, W.; Koegerler, R.; Neufeld, H.; Stremnitzer, H. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik; Bielefeld Univ. (Germany, F.R.). Fakultaet fuer Physik; Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5487 **(NBI-HE—88-55) Comparison of the path-integral and the oscillator approach to covariant loop calculus.** Roland, K. (Niels Bohr Inst., Copenhagen (Denmark)). Aug 1988. 25p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755693/JAW.

We consider the construction of the N-string-loop vertex for the bosonic string. The sewing procedure of J.L. Petersen and J.R. Sidenius (1988) based on path integrals, is reformulated in terms of operators. Complete equivalence with an oscillator approach is demonstrated. The equivalence of two very different loop-sewing procedures is discussed for the g-loop vacuum diagram.

5488 **(NBI-HE—88-56) Monte Carlo evidence for the gluon-chain model of QCD string formation.** Greensite, J. (Niels Bohr Inst., Copenhagen (Denmark); San Francisco State Univ., CA (USA). Dept. of Physics and Astronomy). (Niels Bohr Inst., Copenhagen (Denmark); Niels Bohr Inst., Copenhagen (Denmark); San Francisco State Univ., CA (USA). Dept. of Physics and Astronomy). Aug 1988. 18p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755694/JAW.

The Monte Carlo method is used to calculate the overlaps <PSI/sub string/vertical stroken gluons>, where PSI/sub string/ [A] is the Yang-Mills wavefunctional due to a static quark-antiquark pair, and vertical stroken gluons > are orthogonal trial states containing n=0, 1, or 2 gluon operators multiplying the true ground state. The calculation is carried out for SU(2) lattice gauge theory in Coulomb gauge, in D=4 dimensions. It is found that the string state is dominated, at small qanti q separations, by the vacuum ('no-gluon') state, at larger separations by the 1-gluon state, and, at the largest separations attempted, the 2-gluon state begins to dominate. This behavior is in qualitative agreement with the gluon-chain model, which is a large-N/sub colors/ motivated theory of QCD string formation.

5489 **Existence and stability of nontopological strings.** Copeland, E.; Kolb, E.W.; Lee, K. (NASA/Fermilab Astrophysics Center, Fermi National Accelerator Laboratory, Box 500, Batavia, Illinois 60510-0500). *Physical Review [Section] D: Particles and Fields;* **38**: No. 10, 3023-3030(15 Nov 1988).

The existence of a class of nontopological "string" soliton solutions is demonstrated. The string consists of a long, thin region of false vacuum supported against collapse by the pressure of massless particles trapped in its interior. It is shown that the string configuration is stable against decay into free particles. The stability of such "strings" to arbitrary small perturbations is analyzed and the solutions are shown to be unstable to the migration of charge along the string, leading to a conversion of the nontopological string into spherical nontopological solitons.

5490 **Third quantization and the Wheeler-DeWitt equation.** McGuigan, M. (The Rockefeller University, 1230 York Avenue, New York, New York 10021). *Physical Review [Section] D: Particles and Fields;* **38**: No. 10, 3031-3051(15 Nov 1988).

Beginning with a proposal for the normalization of solutions to the Wheeler-DeWitt equation put forth by DeWitt we argue that the Wheeler-DeWitt equation naturally lends itself to a second quantization in analogy to the second quantization of the Klein-Gordon equation. We identify a conserved current, as well as DeWitt's proposal for normalization, as coming from a Lagrangian which is the analog of a second-quantized string theory whose spatial coordinates parametrize the coset manifold SL(3,R)/SO(3). We derive a mode decomposition of the second-quantized Wheeler-DeWitt field in the linearized approximation to quantum gravity, the zero modes of which are given by the total three-volume as well as various anisotropy parameters. We discuss the possibility of adding topological interactions for the linearized theory and find a representation in terms of vertex operators. In a two-dimensional setting we discuss a connection between our formalism and a proposal by Green which may shed light on some of the interpretational problems of string theory.

5491 Modular-invariant closed-string field theory. Kaku, M.; Lykken, J. (Physics Department, City College of the City University of New York, New York, New York 10031). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3067-3086(15 Nov 1988).

Attempts so far at constructing a covariant closed-string field theory have been frustrated by the fact that modular invariance always appears to be violated. At both the tree and loop levels, moduli space is either overcounted an infinite number of times, or undercounted because of a missing region. We solve this problem by demonstrating that a new Iclosed four-string interactionR is necessary to reproduce the closed-string amplitude which precisely fills the missing region. This closed four-string interaction, which has the topology of a tetrahedron, is predicted by geometric string field theory. The tetrahedron graph is generated by gauge fixing the geometric theory's local gauge group, the unified string group, and is the exact counterpart of the instantaneous four-fermion Coulomb term found in QED. We prove the existence of this tetrahedron graph both analytically and by direct computer calculation and show that it is the key to reproducing the Shapiro-Virasoro amplitude.

5492 Gauge independence of the local trace anomaly of vectors and antisymmetric tensor fields. Nielsen, N.K.; van Nieuwenhuizen, P. (Fysisk Institut, Odense Universitet, 5230 Odense M, Denmark). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3183-3193(15 Nov 1988).

We show that in the path-integral formalism the local trace anomalies of vector fields in d = 4 and antisymmetric tensor fields in d = 6, coupled to an external gravitational field, are gauge independent if one uses the background-covariant gauge-fixing term -(2ξ)/sup -1/ (D/sub μ//sub =/A/sup μ//sup >1/...μ/sub d/2/)^2. Hence, we disagree with recent claims in the literature that the local trace anomaly is gauge dependent.

5493 Skyrme topological soliton coupled to gravity. Glendenning, N.K.; Kodama, T.; Klinkhamer, F.R. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3226-3230(15 Nov 1988).

Skyrmions of large topological quantum number N or large energy scale f/sub π/ are studied in general relativity. No stable or metastable solutions are found between the nucleon with N = 1 and mini black holes with N∼M/sub Planck//f/sub π/. On the nuclear scale (f/sub π/∼90 MeV) this corresponds to N∼10/sup 19/.

5494 Lattice λphi^4 theory with Yukawa couplings to staggered fermions. Polonyi, J.; Shigemitsu, J. (Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3231-3237(15 Nov 1988).

An investigation of the λphi^4 theory coupled via Yukawa couplings to fermions has been initiated on the lattice. Dynamical fermions are taken fully into account, using hybrid-molecular-dynamic algorithms. Different ways of transcribing Yukawa couplings onto the lattice are discussed. It is found that the lattice phase diagram is very sensitive to the manner in which this interaction is regularized. Some results for scalar and fermionic correlation functions are also presented.

5495 Operator renormalization group. Horn, D.; Langeveld, W.G.J.; Quinn, H.R.; Weinstein, M. (School of Physics and Astronomy, Tel-Aviv University, Tel-Aviv 69978, Israel). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3238-3247(15 Nov 1988).

We introduce a novel operator renormalization-group method. This is a new and more powerful variant of the t expansion combining that method with the real-space renormalization-group approach. The aim is to extract infinite-volume physics at t→∞ from calculations of only a few powers of t. Good results are obtained for the (1+1)-dimensional Ising model. The method readily generalizes to higher-dimensional spin theories and to a gauge-invariant treatment of gauge theories. These theories will require greater computational power.

5496 More on the QCD phase diagram at finite temperatures. Gavai, R.V.; Potvin, J.; Sanielevici, S. (Tata Institute for Fundamental Research, Homi Bhabha Road, Bombay 400005, India). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3266-3276(15 Nov 1988).

In order to broaden the existing knowledge about the phase diagram of QCD, we use a Langevin algorithm to study finite-temperature QCD on an 8^3 x 4 lattice with variable flavor number, quark mass, and gauge coupling. We concentrate on the search for first-order transitions for small flavor number and light-quark masses. We find general agreement with the predictions of effective models of the finite-temperature deconfinement and chiral-symmetry-restoration phase-transition mechanisms. In particular, we find that the deconfinement transition extends to lower quark masses as n/sub f/, the number of quark flavors, decreases. Nonperturbative fermionic effects are found to be significant for very light quarks even for n/sub f/ = 0.1. .AE

5497 Light-front QCD in the vacuum background. Gldash-barazek, S. (Institute of Theoretical Physics, The Warsaw University, Hoza 69, PL-00-681 Warsaw, Poland). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3277-3286(15 Nov 1988).

It is shown that the canonical light-front formulation of quantum chromodynamics is able to incorporate ideas used by Shifman, Vainshtein, and Zakharov to successfully describe many features of the hadronic spectrum in their sum rules. It is pointed out that the new light-front Hamiltonian may lead to a quantitative model for the structure of hadrons.

5498 Dimensional reduction in finite-temperature quantum chromodynamics. II. Nadkarni, S. (Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08855-0849). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3287-3294(15 Nov 1988).

The reduction of four-dimensional quantum chromodynamics at finite temperature and chemical potential to an infrared-effective three-dimensional theory is further investigated. The effective couplings are calculated in the manner prescribed by a previously discussed program of quantum dimensional reduction, demonstrating its internal consistency and completing the specification of the effective action. The latter provides a starting point for nonperturbative studies of the infrared behavior of high-temperature quark-gluon plasmas.

5499 Limits on CP invariance in general relativity. Lo-Secco, J.M. (University of Notre Dame, Notre Dame, Indiana 46556). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3313-3313(15 Nov 1988).

The test of the equivalence principle pointed out by Longo and by Krauss and Tremaine can be easily extended to comparing the infall velocities of matter and antimatter. The very close coincidence in arrival times for neutrinos and antineutrinos places strong constraints on the coupling of gravitational interactions to matter and antimatter. The relative difference in gravitational delay is less than 5 x 10/sup -6/.

5500 Gravitational time delay due to a spinning string. Harari, D.; Polychronakos, A.P. (Physics Department, University of Florida, Gainesville, Florida 32611). *Physical Review* [*Section*] *D: Particles and Fields;* **38**: No. 10, 3320-3322(15 Nov 1988).

We show that gravity around a straight cosmic string that carries angular momentum per unit length J induces a delay between the arrival time of two particles that describe an arbitrary closed trajectory around the string with the same speed at each point but in opposite directions. The time delay is 16πGJ, where G is Newton's constant. The particle delayed is the one that circles the closed path in the sense contrary to the angular momentum. As a consequence, double images of a star produced by the string acting as a gravitational lens will acquire a relative time delay, thus providing a mechanism, at least in principle, to measure the string angular momentum. We argue, however, that in any realistic model the time-delay effect is negligible. We also discuss other possible implications of this effect in 2+1 dimensions.

5501 (JINR—D-1,2-86-668-Vol.1, pp 21-34) **New approach to the problem of gauge field quantization.** Skachkov, N.B.; Shevchenko, O.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

A new scheme of calibration field quantization containing considerable change of the procedure of calibration conditions application on field variables is suggested. The above approach is based on a proved theorem on the subordination of fields to the additional Lorenz condition when applying a wide class of initial calibration conditions on these fields. This condition has the sense of the secondary bond, which must be included in the system of bonds during field quantization. The fact of secondary bond presence in the form of Lorenz condition was not earlier considered in literature and used in quantization. Due to this, the report suggests modification of all existing methods of field quantization: according to Dirac-Bergman, covariant approach using an indefinite metric and the method of functional integration. 12 refs.

65 PHYSICS II

REFER ALSO TO CITATION(S) 5322

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 4799, 5368, 5410, 5411, 5412, 5413, 5414

5502 **(CERN-EP—88-73) Relativistic-ion collisions: The first round.** Fabjan, C.W. (European Organization for Nuclear Research, Geneva (Switzerland)). 23 Jun 1988. 20p. (CONF-8803109—9). NTIS (US Sales Only), PC A03. Order Number DE89003191/JAW.

From 23. Rencontre de Moriond conference: electroweak interactions and unified theories; Les Arcs, France (6 Mar 1988).

A wealth of results were obtained in recent experiments with relativistic ion beams, both at BNL and at CERN, and reported at these Rencontres. They are summarized here, and emphasis is given to developments which may shape future experimentation with heavier beams. 50 refs., 12 figs., 2 tabs.

5503 **(DOE/ER/01067—27) Triangle Universities Nuclear Laboratory: Progress report - TUNL XXVII, 1 September 1987--31 August 1988.** (Triangle Universities Nuclear Lab., Durham, NC (USA)). 1988. Contract AC05-76ER01067;FG05-88ER40441;FG05-88ER40442. 138p. NTIS, PC A07/MF A01. Order Number DE89003000/JAW.

This report contains papers in the following areas: fundamental symmetries in the nucleus; dynamics of few-nucleon systems; tensor forces in light nuclei; nucleon-nucleus interaction mechanisms; nuclear structure and reactions; and development and instrumentation.

5504 **(GSI—88-47-Prepr.) Electromagnetic excitation with very heavy ions at and above the Coulomb barrier.** Wollersheim, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Aug 1988. 16p. (CONF-8809118—).

From 20. international summer school on nuclear physics; Mikolajki, Poland (2 Sep 1988).

The present report is part of a systematic study of the electromagnetic properties of strongly deformed and shape transitional nuclei carried out at GSI. The high efficiency particle-gamma detector system is described to perform multiple Coulomb excitation experiments with very heavy projectiles. Some results obtained for the shape transitional nucleus /sup 196/Pt will be presented to exemplify the importance of having access to both the level energies and the E2-transition matrix elements when discussing the possible structure of these states. The second part of this paper is devoted to transfer reactions between very heavy nuclei. In contrast to light projectiles heavy ions offer the possibility to study new phenomena which originate in the much larger Coulomb contribution to the total interaction. In particular, heavy deformed nuclei will be Coulomb excited by the strong electromagnetic field to high spin states already at the time when they start interacting through the nuclear forces. The particle transfer therefore takes place mainly between excited collective states and thus should give information about the interplay between single-particle degrees of freedom, pair correlations and collective excitations. In this paper results of experiments will be reported in which nuclei from the rare earth and the actinide region have been bombarded by /sup 206,208/Pb projectiles at incident energies near the Coulomb barrier. (orig./HSI).

5505 (INIS-SU—62/A, pp 111) **Study of the structure of light nuclei at small distances in experiments on fragmentation of polarized and nonpolarized deuterons.** Naumann, B.; Naumann, L.; Nomofilov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The cross section in the zero angle forward fragmentation reaction A(d,p) has been measured for targets (/sup 1/H, /sup 12/C, /sup 27/Al, /sup 64/Cu) and a fragment momentum, q, of $\leqq$0.6 GeV/c in the antilaboratory frame. The shape of the cross section does not depend on the incident deuteron momentum and on the atomic mass number of the target for q $\geqq$0.1 GeV/c. It has been pointed out that the effect of final state interaction is low. In the frame of the light-front parameter it is clearly shown that deuteron fragmentation, electrodisintegration and backward scattering reactions characterize the nucleon momentum distribution in the deuteron. 2 refs.; 2 figs.

5506 **(Juel-Spez—442) KfA Institute of Nuclear Physics. Annual report 1987.** Gruemmer, F.; Kilian, K.; Schult, O.; Seyfarth, H.; Speth, J.; Turek, P. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Apr 1988. 188p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755418/JAW.

This annual report contains extended abstracts about the work performed at the named institute together with a list of publications and speeches. The work concerns nuclear reactions, nuclear spectroscopy, intermediate-energy physics, nuclear structure, developments of the isochronous cyclotron and the ISIS ion source, construction of spectrometers, detectors, and targets, computer development, counting electronics, and radiation protection. (HSI).

5507 **(LA-UR—88-3948) Recent heavy ion results from CERN and Brookhaven.** Jacak, B.V. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 28p. (CONF-880758—4). NTIS, PC A03/MF A01. Order Number DE89003585/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

Results of the first round of ultrarelativistic heavy ion experiments at CERN and BROOKHAVEN are reviewed. The experiments measure global variables such as transverse energy and multiplicity to characterize the impact parameter of the collisions and compare with geometrical models of heavy ion collisions. Charged particle transverse momentum spectra are measured, and p-nucleus and nucleus-nucleus collisional look rather similar. The hardening of the spectrum at high p/sub t/, previously observed in p-nucleus, is also present in heavy ion collisions. Two-particle interferometry has been used to study the pion source in central collisions. For analysis of all pions pairs, this looks approximately like the tube cut through the target by the projectile, but mid-rapidity pion pairs indicate a large, nearly spherical, very chaotic source. Study of dimuon production in the J/{psi} mass region has shown a suppression of J/{psi} with respect to the continuum in central compared to peripheral collisions. This could be a signal of deconfinement, but careful studies are underway to determine the magnitude of such an effect from nuclear absorption. 28 refs., 14 figs.

5508 **(SLAC-PUB—4713) Nuclear effects in J/{psi} and lepton-pair production.** Brodsky, S.J. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 6p. (CONF-880867—8). NTIS, PC A02/MF A01. Order Number DE89002844/JAW.

From 24. international Rochester conference on high energy physics; Munich, F.R. Germany (4 Aug 1988).

High-energy processes in nuclear media provide important tests of quantum chromodynamics, since in principle one can use the nuclear environment to perturb and study the mechanisms involved in confinement and hadronization. In this talk several examples of nuclear effects in QCD will be discussed that affect the propagation and hadronization of quarks and gluons in nuclear matter. The issues include: possible signatures for quark-gluon plasma formation in heavy ion collisions, particularly J/{psi} production; hadronization due to jet coalescence; the limits of validity of QCD factorization formulae due to initial- and final-state interactions; formation zone physics; shadowing of the quark and gluon structure functions of nuclei; and color transparency in hard quasielastic reactions inside of nuclei. 29 refs., 4 figs.

5509 **Recent References: May through August 1988.** Ramavataram, S. (Brookhaven National Laboratory, Upton, New York 11973). *Nuclear Data Sheets;* **55**: No. 3, 377-441(Nov 1988).

Keywords and references are given for all literature received by the National Nuclear Data Center or assigned key numbers between May and August 1988. (AIP)

5510 (JINR—D-1,2-86-668-Vol.1, pp 341-349) **Study on light nuclei structure on small distances in experiments on fragmentation of polarized and nonpolarized deuterons and / sup 3/He.** Zaporozhets, S.A.; Naumann, B.; Naumann, L. and others. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Consideration is given to the data on cross sections of fragmentation reactions A(d,p)(A=p, /sup 12/C, /sup 27/Al, /sup 64/Cu), /sup 12/C(/sup 3/He,d), /sup 12/C(/sup 3/He,P) with fragment escape at zero angle in the range of q fragment momenta in antilaboratory system from {similar←to}0 up to one, close to the maximal possible. The data on T/sub 20/ tensor analyzing ability of /sup 12/C(d,p) reaction in q ≦250 MeV/c region are presented. It is shown that momentum distributions of d and /sup 3/He fragments are described by the models with known realistic NN-potentials only in q ≦200 MeV/c region. Cooperative analysis of presented and other data on deuteron fragmentation, deuteron electrodisintegration and elastic background dp-scattering was conducted. Possible mechanisms, explaining the observed effect are discussed. 18 refs.; 8 figs.

6511 Experimental Techniques

5511 **(SAND—88-1983C) Ex-vacuo nuclear reaction analysis of deuterium.** Lee, S.R.; Boyle, B.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 29p. (CONF-881151—27). NTIS, PC A03/MF A01. Order Number DE89002362/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

A novel technique for performing in-air d(^{3}He,p) nuclear reaction analysis of deuterium using external ^{3}He ion beams ranging in energy from 0.3-2.0 MeV is presented. Variable on-target beam energies for the depth profiling of deuterium are obtained by varying the transmission distance of the external ^{3}He beam in air. The ex-vacuo nuclear reaction analysis (XNRA) apparatus is described, and measured energy distributions of in-air ^{3}He analysis beams are compared to TRIM simulations. Limitations imposed on depth resolution by the energy spread of the external beam and on detection sensitivity by background nuclear reactions in air are assessed for variable energy depth profiling using d(^{3}He,p) XNRA. Example analyses where XNRA has been used for the multidimensional measurement of deuterium in fusion reactor components are discussed. 16 refs., 8 figs.

6512 Nuclear Properties And Reactions, A=1-5, Experimental

5512 **(FNAL/C—88/153-E) Deep inelastic muon scattering at 500 and 100 GeV.** Wolbers, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). 16 Aug 1988. Contract AC02-76CH03000. 3p. (CONF-8808145—10). NTIS, PC A02/MF A01. Order Number DE89003278/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

A description of experiment E665 at Fermilab is given. Data were taken at muon energies of 500 and 100 GeV and with targets of H_2, D_2, and Xe. Initial analysis of the first run's data has commenced. Physics topics addressed by the experiment are given. 1 ref., 1 fig., 1 tab.

5513 (INIS-SU—62/A, pp 148-151) **Elastic electron deuteron scattering with a tensor polarized nD/sub 3/ target.** Althoff, K.H.; Boden, B.; Burkert, R. and others. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Elastic electron-deuteron scattering with a tensor polarized ND/sub 3/ target was studied. Unpolarized electrons of 2 GeV were scattered from polarized deuterons. The averaged electron scattering angle was 21 deg and Q/sup 2/ was 0.5 (GeV/c)/sup 2/. The top view of the target area is shown. The vector polarization during the measuring period is presented. Spectrometer-arrangement for the coincident detection of the scattered electron and deuteron is shown. The data for Q/sup 2/=(0.5 GeV/c)/sup 2/ have taken and the analysis has starfed. 7 refs.; 3 figs.

5514 (INIS-SU—62/A, pp 152-154) **Photodisintegration of polarized deuterons - a measurement of angular distributions at E/sub γ/=450 and 650 MeV.** Althoff, K.H.; Anton, G.; Bock, B. and others. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

At the Bonn 2.5 GeV synchrotron the target asymmetry of the reaction γ+darrow up -> p+n at photon energies of 450 MeV and 650 MeV and at proton-cm-angles between 25 deg and 155 deg have been measured. As target material was used deuterated ammonia in a dilution cryostat, yielding an average vector polarization of 35%. Proton and neutron were detected in coincidence. The preliminary results were compared with a recent Bonn analysis. 8 refs.; 2 figs.

5515 (INIS-SU—62/A, pp 166-167) **Polarization effects and multipole analysis in deuteron photodisintegration.** Barannik, V.P.; Kulish, Yu.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

The results of the multipole analysis performed with the two models (without dibaryon resonances (DR) and with DR) for the γd -> pn reaction using the experimental data on dσdΩ(E/sub γ/=300-500 MeV), Σ, P, T (E/sub γ/=160-500 MeV are presented. The angular dependence of dσdΩ of Σ-asymmetry and T-asymmetry is obtained. 6 refs.; 3 figs.

5516 **(LBL—26101) Beta-delayed proton emission in neutron-deficient lanthanide isotopes.** Wilmarth, P.A. (Lawrence Berkeley Lab., CA (USA)). 30 Sep 1988. Contract AC03-76SF00098. 136p. NTIS, PC A07/MF A01. Order Number DE89003038/JAW.

Forty-two β-delayed proton precursors with $56 \leqq Z \leqq 71$ and $63 \leqq N \leqq 83$ were produced in heavy-ion reactions at the Lawrence Berkeley Laboratory SuperHILAC and their radioactive decay

properties studied at the on-line mass separation facility OASIS. Twenty-five isotopes and eight delayed proton branches were identified for the first time. Delayed proton energy spectra and proton coincident γ-ray and x-ray spectra were measured for all precursors. In a few cases, proton branching ratios were also determined. The precursor mass numbers were determined by the separator, while the proton coincident x-ray energies provided unambiguous Z identifications. The proton coincident γ-ray intensities were used to extract final state branching ratios. Proton emission from ground and isomeric states was observed in many cases. The majority of the delayed proton spectra exhibited the smooth bell-shaped distribution expected for heavy mass precursors. The experimental results were compared to statistical model calculations using standard parameter sets. Calculations using Nilsson model/RPA β-strength functions were found to reproduce the spectral shapes and branching ratios better than calculations using either constant or gross theory β-strength functions. Precursor half-life predictions from the Nilsson model/RPA β-strength functions were also in better agreement with the measured half-lives than were gross theory predictions. The ratios of positron coincident proton intensities to total proton intensities were used to determine Q/sub EC/-B/sub p/ values for several precursors near N=82. The statistical model calculations were not able to reproduce the experimental results for N=81 precursors. 154 refs., 82 figs., 19 tabs.

5517 **Measurement of the differential cross section for the reaction $^{2}H(\gamma,p)n$ at high photon energies and θ/sub c.m./ = 90°.** Napolitano, J.; Freedman, S.J.; Geesaman, D.F.; Gilman, R.; Green, M.C.; Holt, R.J.; Jackson, H.E.; Kowalczyk, R.; Marchand, C.; Nelson, J.; and others. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439-4843). *Physical Review Letters;* **61**: No. 22, 2530-2533(28 Nov 1988).

We have measured the differential cross section for two-body deuteron photodisintegration at θ/sub c.m./ = 90° and for photon energies between 0.8 and 1.6 GeV. At energies above ≃1.2 GeV, the data appear to obey a simple scaling law predicted by constituent-counting rules assuming parton degrees of freedom for the deuteron and nucleons. Agreement with model calculations based on meson exchange or "reduced nuclear amplitudes" is discussed.

5518 (JINR—D-1,2-86-668-Vol.1, pp 293-301) **Azimuthal correlations in proton interactions with light nuclei.** Glagolev, V.V.; Lebedev, R.M.; Pestova, G.D. and others. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Correlation of experimental data of /sup 4/Hep->dppn reaction with calculations according to Monte-Carlo method was used to show the dependence of kinematic correlations on the type of event sampling. Invariant presentation of correlation analysis results for exclusive experiments was introduced. New results of nucleon pair interaction in final state with deuteron production were obtained. Investigations were conducted with the use of 100 cm hydrogen bubble chamber, exposed in /sup 4/He nucleus beam with 8.6 and 13.5 GeV/c momentum in JINR synchrophasotron. It is shown, that beahviour of /sup 4/Hep->dppn reaction is similar at 8.6 GeV/c and 13.5 GeV/c momenta. Calculations conducted according to Monte-Carlo method provide the satisfactory explanation of the general character of azimuthal correlations of process kinematics. reduction of kinematic correlation, related with deuteron production from correlated nucleons is shown. 9 refs.; 3 figs.; 4 tabs.

5519 (JINR—D-1,2-86-668-Vol.1, pp 334-340) **Proton spectra of 9 GeV/c deuteron fragmentation on hydrogen, deuterium and carbon nuclei and deuteron structure function.** Azhgirej, L.S.; Vzorov, I.K.; Zhmyrov, V.N. and others. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Momentum spectra of protons, emitted at 0.139 rad angle in result of fragmentation of 9 GeV/c deuteron fragmentation on hydrogen, deuterium and carbon nuclei were measured. Experiments were conducted at JINR synchrophasotron using magnetic spectrometer with on line wire chambers. The following conclusions were made: configuration of high-momentum regions of proton spectra of A(d,p)X reactions is noted for universal character, i.e. it doesn't depend on nucleus-target. Relativistic model of hard collisions describes satisfactorily experimental data on /sup 1/H(d,p)X reaction. Measurement of high-momentum spectrum regions of protons emitted with powerful transverse momenta in interactions of relativistic deuterons with nuclei, represents the effective method for studying structure of relativistic deuteron. Experimental data cannot be described using structural functions, derived from nonrelativistic deuteron wave function. This fact means, that structural function must represent the function of two independent variables, describing longitudinal and transverse motion of deuteron constituents. 15 refs.; 2 figs.

6513 Nuclear Properties And Reactions, A=6-19, Experimental

5520 **(DOE/ER/40387—2) A study of the higher excitation levels of ^{11}B via the $^{10}B(n,n)^{10}B$ and $^{10}B(n,n')^{10}B^{*}$(0.72, 1.74, 2.15, 3.59, 4.77 MeV) reactions.** Sadowski, E.T. (Ohio Univ., Athens (USA). Dept. of Physics). Nov 1988. Contract FG02-88ER40387. 198p. NTIS, PC A09/MF A01. Order Number DE89003254/JAW.

As part of the study of the higher energy-level structure of ^{11}B, cross sections for elastic and inelastic scattering of neutrons from isotopically enriched ^{10}B samples have been measured for incident neutron energies from 3.03 MeV to 6.45 MeV in 250 keV increments and from 7.02 MeV to 12.01 MeV in 500 keV increments. Inelastic angular distributions for scattering to the states in parentheses in ^{10}B have been measured from the indicated energy up to 12.01 MeV; (0.718) from 3.02 MeV; (1.74) from 3.27 MeV; (2.15) from 3.77 MeV; (3.59) from 5.52 MeV; (4.77) from 7.02 MeV. The measurements at 3.02, 3.51, 4.02, and 4.51 MeV were done at nine laboratory angles from 20{degree} to 158{degree} in 17.5{degree} increments with a sample that is isotopically 95.86% ^{10}B. All other distributions measured scattering at 11 laboratory angles from 18{degree} to 158{degree} in 15{degree} increments from a sample that is isotopically 99.49% ^{10}B. The data are corrected for air scattering, sample attenuation, minor isotope impurity, multiple scattering, and elastic and inelastic scattering from the sample of the neutron source continuum and contaminants. An eight-channel, multilevel R-matrix analysis was performed on the data. Level energies, spins, and parities were deduced for twelve levels above 13 MeV excitation in ^{11}B. Only two definite and three tentative assignments for T = {1/2} levels had been made previously above 13 MeV. The two definite levels were confirmed. Good agreement between the data and the R-matrix calculation in all analyzed channels was obtained for the proposed structure. 122 refs., 40 figs., 7 tabs.

5521 (INIS-SU—62/A, pp 162-165) **Measurement of the parity violation in quasi-elastic electroweak electron-scattering from /sup 9/Be.** Achenbach, W.; Ahrens, J.; Andresen, H.G. and others. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik; Max-Planck-Institut fuer Chemie (Otto-Hahn-Institut), Mainz (Germany, F.R.); Mainz Univ. (Germany, F.R.). Inst. fuer Kernphysik). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Measurement of the Parity Violation in Quasi-Elastic Electroweak Electron-Scattering from /sup 9/Be in the energy range of about 300 MeV is fulfilled. The measurement of the parity violating asymmetry is obtained by a comparison of scattering for a + helicity beam to that for a - helicity beams. To permit a meaningful comparison required that the + helicity and the - helicity beams being identical in all other respects. Measurements at different energies and targets (hydrogen, deuterium) in the medium energy region will allow to determine α, β γ, δin a model-inde-

pendent way. Regarding future experiments at the Mainz microtron cw accelerator, coincidence experiments will open new experimental possibilities for large solid angle detector systems. 5 refs.; 7 figs.; 1 tab.

5522 **(LA-UR—88-3854) Low-energy pion double charge exchange and nucleon-nucleon correlations in nuclei.** Leitch, M.J. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 24p. (CONF-8810235—1). NTIS, PC A03/MF A01. Order Number DE89003492/JAW.

From Workshop on nuclear structure with medium energy probes; Santa Fe, NM, USA (12 Oct 1988).

Recent measurements of pion double-charge exchange (DCX) at energies 20 to 70 MeV are providing a new means for studying nucleon-nucleon correlations in nuclei. At these energies the nucleus is relatively transparent, allowing simpler theoretical models to be used in interpreting the data and leading to a clearer picture. Also the contribution to DCX of sequential charge-exchange scattering through the intermediate analog state is suppressed near 50 MeV and transitions through non-analog intermediate states become very important. Recent theoretical studies by several groups have shown that while transitions through the analog route involve relatively long nucleon-nucleon distances, those through non-analog intermediate states obtain nearly half their strength from nucleon pairs with less than 1 fermi separation. Thus DCX near 50 MeV is an excellent way to study short-range nucleon-nucleon correlations. Data has been obtained for double-isobaric analog state (DIAS) transitions on ^{14}C, ^{18}O, ^{26}Mg, and a number of nuclei in the f-7/2 shell including /sup 42,44,48/Ca, primarily at 35 and 50 MeV. Additional data for non-analog (ground state) transitions has also been obtained for ^{12}C. These data are consistent with the two-amplitude theoretical models where the two amplitudes represent scattering through analog and through non-analog intermediate states. Calculations based on shell-model correlations explain the general trends of the data. Preliminary new data on the forward-angle energy dependence of the DIAS and g.s. transitions for /sup 42,44,48/Ca from 25 to 70 MeV is presented here and the current theoretical picture based upon this data is reviewed. 26 refs., 31 figs., 4 tabs.

6514 Nuclear Properties And Reactions, A=20-38, Experimental

5523 **(DOE/ER/40404—T2) Nuclear chemistry progress report.** (Indiana Univ., Bloomington (USA)). Aug 1988. Contract FG02-88ER40404. 63p. NTIS, PC A04/MF A01. Order Number DE89003315/JAW.

The activities of the Nuclear Chemistry program at Indiana University during the period of August 1, 1987 to July 31, 1988 are summarized in this report. The primary focus of this experimental program has been: the study of nucleon-exchange and excitation-energy division between projectile-like and target-fragments in damped collisions just above the interaction barrier, and characterization of the mechanisms of energy and momentum dissipation in intermediate-energy collisions, with emphasis on complex fragment emission and the relative contributions of fully equilibrated and non-equilibrated process. The objective of this research has been to improve our understanding of the time evolution of energy and matter flow in collisions between complex nuclei and the behavior of highly excited nuclear matter.

6517 Nuclear Properties And Reactions, A=90-149, Experimental

5524 **(IC—88/214) Observation of Baryonic clusters in central Mg/sup 24/+Ag(Br) collisions at 4.5 A GeV/c.** Baranik, A.T.; El-Naghy, A.; Abdel-Aziz, S.S. (Cairo Univ., Giza (Egypt). Dept. of Physics). (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1988. 3p. (CONF-880766—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704739/JAW.

From 5. international conference on clustering aspects in nuclear and subnuclear systems; Kyoto, Japan (25 Jul 1988).

An analysis of azimuthal angular distribution of grey particles, corresponding to proton kinetic energy approx.= 27-400 MeV in central collisions of Mg/sup 24/ with emulsion at 4.5 A GeV/c is presented. This analysis indicates a clustering within the grey particles. 3 refs, 1 fig.

6519 Nuclear Properties And Reactions, A=190-219, Experimental

5525 **(CONF-8806225—2) Momentum distributions of neutral pions in heavy ion reactions at the CERN-SPS.** Loehner, H.; Albrecht, R.; Awes, T.C.; Baktash, C.; Beckmann, P.; Berger, F.; Bock, R.; Claesson, G.; Dragon, L.; Ferguson, R.L. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003181/JAW.

From 9. international seminar on high energy physics problems relativistic nuclear physics and quantum chromodynamics; Dubna, USSR (14 Jun 1988).

A systematic study of nucleus{plus}nucleus reactions at ultrarelativistic energies has been started in 1986 with oxygen beams of 60 and 200 A{center←dot}GeV in the CERN-SPS in order to investigate nuclear matter under extreme conditions of density and excitation energy. According to QCD lattice calculations a first or second order transition to the deconfined phase of quarks and gluons, the quark-gluon-plasma (QGP), may occur in a finite volume of hadronic matter at energy densities larger than the energy density inside the nucleon. First experimental results from ^{16}O {plus} nucleus reactions show that, in the most central events, energy densities above 2 GeV/fm^3 are reached. Up to now, cosmic ray data have been the only source of information and the observed rise of their transverse momenta with energy density has been interpreted as due to QGP effects. Since the signature of the QGP is not well established, p {plus} nucleus data have been taken for comparison to the nucleus{plus}nucleus data at the same incident energy per nucleon in order to observe in the heavy ion induced reactions any deviation in the distribution of transverse momenta. 29 refs., 7 figs.

5526 **(GSI—88-46-Prepr.) New component of the collective flow in relativistic heavy-ion collisions.** Gutbrod, H.H.; Kolb, B.W.; Schmidt, H.R.; Kampert, K.H.; Poskanzer, A.M.; Ritter, H.G. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.); Lawrence Berkeley Lab., CA (USA). Nuclear Science Div.). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Muenster Univ. (Germany, F.R.)). Aug 1988. 12p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755573/JAW.

The reaction Au+Au at 400 MeV/nucleon is analyzed in the coordinate system given by the principal axes of the kinetic energy flow ellipsoid. In addition to the previously observed sidesplash and bounce-off we find a pronounced component perpendicular to the reaction plane at mid-rapidity both in position- and momentum-space. The anisotropy is investigated as a function of multiplicity and is found to be most prominent for semi-central collisions.

5527 **(INIS-mf—11832) Impact parameter dependent light particle correlations for /sup 40/Ar induced reactions on /sup 197/Au at E/A = 60 MeV.** Kyanowski, A. (Freie Univ. Berlin (Germany, F.R.). Fachbereich Physik). 15 Jul 1987. 108p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755411/JAW.

With the help of a multidetector system of 96 plastic detectors, mounted in the forward hemisphere between 3/sup 0/ and 30/sup 0/, we measured light charged particles to make an off-line event-type selection. The final aim to distinguish different impact parameter domains with the plastic wall could be achieved using the observed multiplicity as the sampling parameter. With the help of a computer simulation based on a participant-spectator model to describe the reation, the mean observed multiplicity could be established to vary smoothly with the total multiplicity, a variable which is often cited as an indicator for the violence of a reaction. Even if the simulation indicates a broad distribution of the observed multi-

plicity over the different impact parameters, we could separate the extreme cases of peripheral and central collisions. If the events are selected with the appropriate multiplicity gates, it turns out that peripheral collisions give rise to enhanced correlations, whereas the correlation function is strongly reduced for central collisions. Between these extreme values the correlation reduces smoothly with the impact parameter. The space-time extent of the emitting system is therefore larger for small impact parameters than in peripheral collisions. Supposing that the spatial extent is rather independent of the impact parameter (except for very peripheral collisions) we suggest that the observed variation of the correlation function could indicate a variation of the emission time for light particles rather than a spatial evolution. On the contrary the temperature, determined equally after an event-type selection with the observed multiplicity, shows no variation with the impact parameter. This could indicate that a limiting temperature is reached at a value at which the emission of particles is faster than the temporal development of the temperature. (orig./HSI).

6520 Nuclear Properties And Reactions, A=220 And Above, Experimental

5528 (INIS-mf—11328, pp 61) **Spontaneous emission of heavy ions (exotic radioactivity).** Weselka, D.; Hille, P. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5529 (INIS-mf—11328, pp 86) **Spontaneous emission of heavy ions from radium- and thorium isotopes.** Weselka, D.; Hille, P. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5530 **(INIS-mf—11828) Study of alternative decays of the shape isomers /sup 238m/U and /sup 237m/Np.** Steinmayer, M. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 24 Jun 1987. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755407/JAW.

In this thesis measurements on the α and γ decay of the shape isomers /sup 237m/Np and /sup 238m/U are presented. In the measurements on the α back-decay the shape isomers were produced in a /sup 238/U(d,pn)/sup 238m/U respectively /sup 238/U(d,3n)/sup 237m/Np reaction at 15.5 Mev incident energy. The searched α decay was not observed. We determined upper limits for the ratio of the decay widths of α back-decay and isomeric fission. In the /sup 238/U(d,pn)/sup 238m/U reaction two γ lines were observed in coincidence width conversion electrons. They are interpreted as the decay of the shape isomer in /sup 238/U to the 2/sup +/ level at 44.9 keV respectively to the 1/sup -/ level at 680.0 keV with subsequent decay to the 2/sup +/ level. The shape isomer /sup 237m/Np was populated in a /sup 238/U(p,2n)/sup 237m/Np reaction at 12 MeV incident energy. No significant delayed γ line in coincidence with conversion electrons was measured which would to be assigned to one of the shape isomers. We obtain the upper limit of 30 μbarn for the cross section of a delayed γ transition of the energy 2.0 MeV $\leqq$ E/sub g/ $\leqq$ 3.9 MeV with half-life t/sub 1/2/ = 45 ns in coincidence with a converted transition. In the framework of these measurements a new isomer in the first minimum of /sup 237/Np was detected at 945.1 keV excitation energy. 6 lines could be assigned to the decay of the K isomer. As most probable spin and K value I = K = 13/2 at uncertain parity were determined. (orig./HSI).

5531 **(INIS-mf—11829) On the energy balance and on dynamical aspects of proton induced fission of /sup 235,236,238/U by coincident spectroscopy of neutrons and fragments.** Wien, R. (Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 8 Dec 1986. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755408/JAW.

An improved experimental set up has been developed and applied to the measurement of neutrons in coincidence with fragments originating in proton induced fission of heavy nuclei. The reaction systems studied were p+/sup 235,236,238/U for E/sub p/ = 12.84 MeV and E/sub p/ = 20.4 MeV. Data interpretation focuses on the following aspects: 1. Neutron multiplicities and average kinetic energies were studied as a function of fragment mass and total kinetic energies of these fragments. 2. The isotropic (i.e. the prefission plus scission) neutrons reveal a dependence of their multiplicities on the primary excitation energy E/sup *//sub CN/ that indicates a preference of the neutron over the fission exit channel with increasing E/sup *//sub CN/ not found in statistical model calculations. 3. A consistent analysis of all existing data for p+/sup 235,236,238/U covering the interval 18 MeV $\leqq$ E/sup *// sub CN/ $\leqq$ 30 MeV in terms of neutron multiplicities and nuclear temperatures yields that pre- and postfission neutrons carry away comparable fractions of the additional energy ΔE/sup *//sub CN/. 4. The total energy released in neutron and fragment emission is shown for p+/sup 238/U (E/sub p/ = 20.4 MeV) to compare with the energy expected from mass tables for the fragmentations selected to within 2-3%.

5532 **(INIS-mf—11842) Ternary fission.** Theobald, J.P. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). [1988]. 15p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755581/JAW.

This is a report on experimental results obtained with the double torus ionization chamber 'DIOGENES', which has been developed for the investigation of particle associated fission. The role of ternary fission for the understandig of the fission will be discussed.

5533 **(JINR—R-3-87-862) Investigation of prompt gamma-ray yields as a function of mass and charge of /sup 236/U fission fragments.** Bogdzel', A.A.; Gundorin, N.A.; Duka-Zojomi, A.; Kliman, Ya.; Krishtiak, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1987. 12p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88704390/JAW.

New experimental results determining yields of the prompt gamma-rays from the excited states decay of fission fragments are presented. 80 gamma-transitions were observed in 51 fission fragments. The measurements were performed by Ge(Li)-spectrometry in coincidence with fast ionization chamber (10g /sup 235/U). The beam of the resonance neutrons with energy range from 0.7 to 36 eV was used. 17 refs.; 5 figs.; 2 tabs.

5534 **(ORNL/TM—10999) Neutron absorption cross section of uranium-236.** Macklin, R.L.; Alexander, C.W. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 20p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003722/JAW.

U-236 neutron absorption was measured as a function of neutron time-of-flight from 20 eV to 1 MeV. The neutron flux was monitored with a ^{6}Li glass scintillator. Average cross sections from 3 keV to 1 MeV were derived. Estimated uncertainties were less than 5% below 600 keV and increased to 9.5% at 1 MeV. Resonance parametrization from 20 eV to a few keV remains to be done. 17 refs., 5 figs., 3 tabs.

5535 **(PINSTECH/NPD—122) Kinematical analysis of 2-, 3- and 4-body channels in the reaction (1.25 MeV/u) Kr/sup/84 + U/sup/nat observed with mica track detectors.** Qureshi, I.E.; Khan, H.A.; Rashid, K.; Vater, P.; Brand, R.; Gottschalk, P.A. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Nuclear Physics Div.). Sep 1987. 52p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE88704403/JAW.

The exclusive measurements of reactions induced by 1050 MeV Kr ions incident on natural uranium have been made with the help of mica track detectors used in 2 pie-configuration. The cross-sections for ternary and quarternary events have been determined by directly complete kinematical picture of the reaction process has been deduced by converting the three dimensional track parameters (lengths and angles) into parameters of reaction products (masses and energies) on an event basis. An empirical velocity-range relation has been used for this purpose, which has been obtained by an internal calibration procedure. It has been found that the reaction mechanism for the bulk of the data can be described as a sequential fission process. Final mass distributions and total kinetic energy losses have been obtained for all channels. In order to estimate the uncertainties of computed quantities in relation to the measurement errors, Monte-Carlo simulation of the selected data sets has also been performed. (orig./A.B.). 16 fig.

5536 (ZfK—584, pp 1) **Total kinetic energy versus mass distributions obtained by investigation of the collision system /sup 40/Ar + /sup 232/Th.** Gippner, P.; Schilling, K.D.; Seidel, W.; Stary, F.; Will, E.; Sodan, H.; Lukyanov, S.M.; Chubarian, G.G.; Salamatin, V.S.; Penionzhkevich, Yu.E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Joint Inst. for Nuclear Research, Dubna (USSR)). Apr 1986. NTIS (US Sales Only), PC A09/MF A01. Order Number DE89780007/JAW.

In Annual report 1985 on nuclear physics activities and applications.

5537 **Local deviations from the Grodzins systematics: Enhanced collectivity in the transitional Ra-Th nuclei.** Gai, M. (A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511). *Physical Review Letters;* **61**: No. 21, 2424-2427(21 Nov 1988).

Local deviations from the Grodzins systematics for the product $E(2^+)B(E2)$ are observed in several light Ra-Th nuclei. We note an abrupt increase to 5.5% of the isoscalar E2 energy-weighted sum rule, almost a factor of 2 above the value typically found near shell closures and equal to the value found in the very deformed actinides. This indicates mixing of a low-lying deformed state into the ground state of the light Ra-Th nuclei, as expected for a low-lying cluster state. Evidence for mixing of a deformed state is also present in the rms radii and binding energies of these nuclei.

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 5477, 5478, 5479, 5507

5538 **(DOE/ER/40246—3) Neutron scattering studies in the actinide region: Progress report, December 1, 1985--July 31, 1988.** Beghian, L.E.; Kegel, G.H.R. (Lowell Univ., MA (USA). Radiation Lab.). Aug 1988. Contract FG02-86ER40246. 50p. NTIS, PC A03. Order Number DE89003810/JAW.

During the report period we have been active in the following research areas: neutron elastic and inelastic scattering measurements on low-lying levels of actinide nuclei; cross section measurements of neutrons scattered inelastically from highly excited states in Th-232 and U-238 for incident energies above 2 MeV; low energy inelastic scattering measurements using neutron filters; preliminary work on fast fission spectrum measurements; and improvements in accelerator operation. 4 refs., 2 figs.

5539 **(DOE/ER/40273—3) Research in theoretical nuclear physics: Progress report, March 1, 1986--February 28, 1989.** Robson, D. (Florida State Univ., Tallahassee (USA)). 1989. Contract FG05-86ER40273. 7p. NTIS, PC A02/MF A01. Order Number DE89003095/JAW.

Our investigations over the last three years have involved two major areas of endeavor. The first area is Hamiltonian Lattice Gauge Theory which involved a collaborative effort between the Florida State Group (Chris Long and Don Robson) and S.A. Chin (Texas A & M). The second area is models of hadrons and hadronic interactions based on quarks, pions and the basic QCD symmetries, i.e., chiral symmetry and local SU(3) color gauge invariance. These three years have been very productive as evidenced by the twelve papers (A1 → A12) published (or in press) as well as the various invited papers (B1 → B5) given by the Principal Investigator at several meetings. In what follows we report on the results obtained in lattice gauge calculations using SU(N) gauge groups and on results obtained with hadronic models.

5540 **(DOE/ER/40335—3) Theoretical nuclear physics: Progress report, October 1, 1987--October 1, 1988.** Kunz, P.D.; Rost, E. (Colorado Univ., Boulder (USA)). Sep 1988. Contract FG02-87ER40335. 32p. NTIS, PC A03/MF A01. Order Number DE89003097/JAW.

This paper discusses the following topics: Formulation of Non- Spectral Dirac Random Phase Approximation (RPA); Description of Discrete Transitions Using the Non-Spectral Dirac RPA; Sum Rules in Dirac RPA; The Coulomb Response for Quasi-Elastic (e,e') in Dirac RPA; Galerkin Approach to Dirac Problem with Finite Basis Splines; Open-Shell Nuclei in a Relativistic Mean-Field Model; An Alternative Interaction for the Relativistic Love Franey Model; Relativistic Suppression Factors in (p,d) Reaction Calculations; Effects of Initial and Final State Interactions on the P{bar P} → Λ{bar {Lambda}} Reaction; and Deuteron Knockout in the (e,e'd) Reaction.

5541 **(GSI—88-38-Prepr.) Neutron rich clusters and the dynamics of fission and fusion.** Armbruster, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1988. 18p. (CONF-880766—). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755571/JAW.

From 5. international conference on clustering aspects in nuclear and subnuclear systems; Kyoto, Japan (25 Jul 1988).

In this lecture I want to discuss experimental evidence for the appearance of cluster aspects in the dynamics of large rearrangement processes, as fusion and fission. Clusters in the sense as used in my lecture are the strongly bound doubly magic nuclei as / sub 20/Ca/sub 28//sup 48/, /sub 28/Ni/sub 50//sup 78/, /sup 132//sub 50/Sn/sub 82/, and /sup 208//sub 82/ Pb/sup 126/ and the superheavy nucleus /sup 298/114/sup 184/. Two of these nuclei, /sup 78/Ni and /sup 298/114 have not yet been identified. I discuss first the experimental findings from heavy element production. Then I cover the stability of cluster aspects to intrinsic excitation energy in fusion and fission. (orig./HSI).

5542 (INIS-mf—11328, pp 14) **Behavior of nuclei at high angular momenta.** Faessler, A. (Tuebingen Univ. (Germany, F.R.). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5543 (INIS-mf—11328, pp 86) **Calculation of nuclear level density by the spectral distributions method for /sup 20/Ne and /sup 24/Mg.** Strohmaier, B.; Grimes, S.M. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik; Ohio Univ., Athens (USA). Dept. of Physics). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5544 (INIS-mf—11328, pp 77) **Relativistic heavy ion physics - results and plans.** Fabjan, C.W. (European Organization for Nuclear Research, Geneva (Switzerland)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5545 (INIS-mf—11328, pp 60) **Information content of optical potential analyses.** Schnizer, W.A.; Leeb, H.; Fiedeldey, H.; Krappe, H.; Lipperheide, R. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria); UNISA, Department of Physics, Pretoria (South Africa); Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5546 (INIS-mf—11328, pp 78) **Transfer reactions at stellar energies.** Oberhummer, H.; Herndl, H. (Technische Univ. Vienna, Institut fuer Kernphysik, Vienna (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5547 (INIS-mf—11328, pp 82) **Interferometry with coincident neutrons from the compound nucleus.** Otten, D.; Assmann, W.; Duennweber, W.; Hering, W.; Konnerth, D.; Lippich, W.; Trombik, W. (Muenchen Univ. (Germany, F.R.). Sektion Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5548 (INIS-mf—11328, pp 82) **Elastic electron-deuteron scattering evaluated with the energy-dependent Bonn nucleon-nucleon potential.** Pauschenwein, J.; Mathelitsch, L.; Plessas, W. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5549 (INIS-SU—62/A, pp 37-38) **Physics of polarized deuteron.** Frankfurt, L.L.; Strikman, M.I. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Physics of polarized deuterons in coherent eD -> eD-vector and incoherent eD-vector -> eD processes are considered. S-and D-wave deuteron wave functions (WF) are measured. Compact configurations in deuteron 2N, 6q bag, Δ4D, sensitive to the quark structure are studied. Predictions for the spin structure of the short range deuteron WF vary considerably in the Skyrme model and in the MIT bag model. The ratio of the spectator nucleon yields for the scattering off D-vector and D is considered and several comments are given. 4 refs.

5550 (INIS-SU—62/A, pp 155-156) **Polarization effects in the process of inelastic electron scattering by deuterons.** Rekalo, M.R.; Gakh, G.I.; Rekalo, A.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. NTIS (US Sales Only), PC A11/MF A01. Order Number DE89780025/JAW. (CONF-8609151—).

From 7. international symposium on high energy spin physics; Protvino, USSR (22 Sep 1986).

Polarization effects in the inelastic electron scattering by deuterons d-vector(e-vector, e'p)n were studied. The deuteron structure was taken into account by introducing relativistic form factors of the dnp-vertex. The nucleon electromagnetic form factors were calculated with the dipole parametrization and the scaling law. 5 refs.; 2 figs.

5551 (JINR—R-4-87-100) **Yield of evaporated α particles in heavy ion reactions.** Volkov, V.V.; Ershov, S.N.; Ivanova, S.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1987. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88704391/JAW.

Submitted to the journal Izv. AN SSSR, Ser. Fiz.

The cross sections for α-particle emission from a compound nucleus in some nuclear reactions have been calculated. Agreement for theoretical and experimental results for the first group of reactions, where a projectile particles are /sup 12/C, /sup 16/O is good. For another group with /sup 40/Ar there is a significant disagreement for the yield of experimental and calculated evaporated α-particles. It is possible to understand such a difference by the mechanism of centrifugal fragmentation. 23 refs.; 2 tabs.

5552 (Juel—2163) **Electromagnetic processes in relativistic heavy ion collisions.** Bertulani, C.A.; Baur, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Universidade Federal do Rio de Janeiro (Brazil). Inst. de Fisica). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Oct 1987. 117p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755962/JAW.

A study of the processes generated by the electromagnetic interaction in relativistic nuclear, and atomic collisions is presented. There is nowadays a vivid interest in this field due to the construction of relativistic heavy ion accelerators. Certainly, the most important purpose of these relativistic heavy ion machines is the study of nuclear matter under extreme conditions. In central nucleus-nucleus collisions one hopes to observe new forms of nuclear matter, like the quark-gluon plasma. On the other hand, very strong electromagnetic fields for a very short time are present in distant collisions with no nuclear contact. Such fields can also lead to interesting effects, which are discussed here. There has been many interesting theoretical and experimental developments on this subject, and new areas of research were opened. Of special interest is, e.g., the case of nuclear fragmentation. This is accomplished through the excitation of giant resonances or by direct breakt-up of the nuclei by means of their electromagnetic interaction. It is shown that this process can be used to study nuclear structure properties which are not accessible by means of the traditional electromagnetic excitation at nonrelativistic energies. The creation of particles is also of interest due the large cross sections, specially in the case of electron-positron pair creation. Although to explain the many processes originated in this way one can develop very elaborate and complicated calculations, the results can be understood in very simple terms because of our almost complete comprehension of the electromagntic interaction. For those processes where the electromagntic interaction plays the dominant role this is clearly a very useful tool for the investigation of the structures created by the strong interaction in the nuclei or hadrons.

5553 (LA-UR—88-3639) **Decay of hypernuclei.** Gibson, B.F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 21p. (CONF-8809143—4). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003464/JAW.

From Hypernuclear and low-energy kaon physics; Padova, Italy (12 Sep 1988).

The experimental and theoretical situation regarding the mesonic and nonmesonic decays of light hypernuclei is reviewed. Nuclear matter and shell model estimates for nonmesonic decays are compared within the one-boson-exchange model approximation. The importance of strangeness exchange is explored as well as the spin-isospin dependence of the nonmesonic weak decays. 30 refs., 3 tabs.

5554 (LA-UR—88-3698) **Light-front potentials from meson field theory.** Johnson, M.B. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-880758—3). NTIS, PC A02/MF A01. Order Number DE89003473/JAW.

From Workshop on nuclear and particle physics on the light cone; Los Alamos, NM, USA (18 Jul 1988).

In this talk I will address the feasibility and desirability of building a theory of nuclei around nucleon-nucleon potentials defined on the light front. 11 refs.

5555 **Nuclear stopping at intermediate beam energies.** Bauer, W. (W. K. Kellogg Radiation Laboratory 106-38, California Institute of Technology, Pasadena, California 91125). *Physical Review Letters;* **61**: No. 22, 2534-2537(28 Nov 1988).

We perform an analysis of exclusive heavy-ion reactions around 100 MeV/nucleon in terms of multipole moments of the momentum distribution of nucleons. Numerical calculations based on the Boltzmann-Uehling-Uhlenbeck theory are presented and compared to an approximate scaling function. We find that nuclei completely stop each other even at 100 MeV/nucleon, if A/sub P/ +A/sub T/>200 in symmetrical central collisions. We propose that the mass dependence of the quadrupole momentum tensor can be used to determine the nuclear compressibility.

5556 (JINR—D-1,2-86-668-Vol.1, pp 389-405) **Six-quark clusters and nuclear properties.** Miller, G.A. (Washington Univ., Seattle (USA). Inst. for Nuclear Theory; Washington Univ., Seattle (USA). Dept. of Physics). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Nuclear properties are explained by using of a model which is consisted of nucleons, mesons and six-quark bags. Quark effects seem to have a significant influence on a variety of nuclear properties. The calculations presented employ a very crude quark model. However the order of magnitude of these effects is reasonably well constrained and the results will survive more detailed computations. 33 refs.; 4 figs.

5557 (JINR—D-1,2-86-668-Vol.1, pp 406-418) **Possibility of exclusive and inclusive processes in study on quark configurations in nuclei.** Neudachin, V.G.; Obukhovskij, I.T.; Chuvil'skij, Yu.M. (Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Effects, linked with quark configurations in the lightest nuclei are considered. Analysis of results of calculations according to the resonating group model (RGM) is conducted and numeric values of quark contribution evaluation constants within the framework of a hybride model are determined. Evaluations of quark configuration contributions into the scattering cross sections (e,e) and (e,e') in the lightest nuclei are given. Conclusions, concerning the observed effect consideration conducted are formulated. 6q-component probability βsup 2/=0.03, which follows from RGM-calculations, is obviously the upper limit which still satisfies the quite exact data on deuteron and tritium magnetic formfactors and isovector magnetic transitions d(e,e')pn. Contributions of heavy meson exchange and 6 q-contributions are mutually exclusive both in NN-interaction and in the lightest nucleus magnetic formfactors. If one takes a six quark interpretation as the basis, one may define kinematic areas in which different process cross sections are determined by 6q-component: Q/sup 2/ {similar←to}20-30 fm/sup -2/ in d(e,e')pn(E/sub p/=3 MeV) reaction; Q/sup 2/ {similar←to}40-50 fm/sup -2/ in elastic d(e,e)-backscattering and in d(e,e')B(E/sub p/ {similar←to}300 MeV) dibaryon electroproduction. 36 refs.; 4 figs.; 1 tab.

5558 (JINR—D-1,2-86-668-Vol.1, pp 115-119) **Study on chiral bag model in nuclear matter.** Bunatyan, G.G. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

To study nucleons a model of chiral bag (CBM) is considered where a significant role is played by the interaction on the surface of a bag of enclosed quarks with a meson field. If a nucleon bag is not in a vacuum but in a nuclear matter its pion field changes due to interaction with the media. The change of pion field properties is the more significant the higher nuclear matter density is. A physical nature of appearing of instability of nuclear matter state containing only simple three-quark nucleon bags at high densities is found. Density growth increases the pion field. 4 refs.

5559 (JINR—D-1,2-86-668-Vol.1, pp 259-267) **New data on deep inelastic nuclear reactions and some aspects of analysis.** Leksin, G.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

New data on properties of cumulative particles or properties of deep inelastic nuclear reactions, related with the mechanism of reaction procedure are discussed. Consideration is being given not to concrete models, reflecting various approaches to the complex multiparticle problem, but to some scenario of procedure of deep inelastic nuclear reaction, taking into account the variety of approaches of many models. 13 refs.; 5 figs.

5560 (JINR—D-1,2-86-668-Vol.1, pp 318-325) **Cumulative and deep inelastic processes and quark structure of nuclei.** Bazhanskij, I.I.; Kaptar', L.P.; Reznik, B.L.; Titov, A.I.; Umnikov, A.Yu. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Quark structure of nuclei is investigated on the basis of considering cumulative hadron-nuclear and deep-inelastic lepton-nuclear reactions. Consideration is given to two processes, where introduction of high-momentum nucleon or multi-quark components results to qualitatively different results: the ratio of yields of cumulative π/sup +/ and K/sup +/ mesons in pD-collisions in the region of deuteron fragmentation and deep-inelastic D-scattering on polarized deuterium. The course of both processes depends on assumptions about deuteron structure. 20 refs.; 4 figs.

5561 (JINR—D-1,2-86-668-Vol.1, pp 350-351) **Correlations and very inelastic electronuclear reactions.** Laget, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Haute Energie). 1987. NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The problems of the Bauff lectures are summarized. The study of the (e,e'p) reaction for small values of the photon four-momentum has led to strong constraints on the D and /sup 3/He wave function up to momentum of the order of 500 MeV/c. The two-nucleon correlations in the (e,e'pp) reaction are considered. Selection rules strongly suppress the two-body currents in the transverse cross sections. Two-body correlations provided that final state interactions are carefully taken into account. 7 refs.

5562 (JINR—D-1,2-86-668-Vol.1, pp 374-378) **Relativistic theory of deuteron photodisintegration: (gauge) invariance and meson exchange currents.** Nagornyj, S.I.; Kasatkin, Yu.A.; Kirichenko, I.K.; Inopin, E.V. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

Method for Lorentz-gauge-invariance accounting of bound system structure in the field theory at the light front rhox=0 is developed. Multiparticle effects of exchange current method (ECM) and final-state interaction (FSI) in a triplet spin state are accounted automatically. ECM and FSI effects in a singlet spin state should be additionally accounted by calculating gauge-invariance matrix elements of triangular diagram. The method developed allowed one to describe the whole set of experimental data by deuteron photodisin-

tegration up to the meson threshold without adjustment parameters. 16 refs.; 2 figs.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 4835

5563 **(INIS-mf—11831) Sputtering yield of gold during the irradiation with thermal neutrons.** Selbach, J. (Bayreuth Univ. (Germany, F.R.)). 18 Jul 1986. 103p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755410/JAW.

The present thesis deals with investigations to the sputtering yield of gold during the irradiation with thermal neutrons. Additional to the measurements model calculations have been performed. (BHO).

5564 (INIS-SU—58, pp 63-65) **Calculating the energy spectrum of neutrons from tritium target of the NG-150 type generator.** Bortash, A.I.; Kuznetsov, V.S. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780024/JAW.

Voprosy atomnoj nauki i tekhniki.; no.2(35).

In Radiation technology. Scientific-technical collection.

Calculation procedure of neutron spectra yielding from the NG-150 generator target chamber with regard to deutron moderation is suggested. Using the suggested procedure, neutron spectra for different escape angles formed in the tritium target are calculated. The spectrum of neutrons scattered in cooling water is calculated. The mean energy of neutrons escaping at the angle of 0 deg equalling 14.5 MeV is obtained. 6 refs.; 2 figs.

5565 **(IPP—9/64) TRIDYN - binary collision simulation of atomic collisions dynamic composition changes in solids.** Moeller, W.; Eckstein, W. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). May 1988. 89p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755584/JAW.

CRAY-XMP; FORTRAN 77.

The report deals with the computerized simulation of the following problem: a beam of fast ions entering a solid substance is slowed down and scattered due to electronic interaction and nuclear collisions. Together with created recoil atoms local compositional changes are produced. For large fluences collisional mixing is caused in layered substances. (BHO).

5566 **(ORNL/TM—10824) Preliminary ANS [Advanced Neutron Source] reactor cold source gain factor calculations for liquid deuterium and liquid nitrogen-15.** Henderson, D.L. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 34p. NTIS, PC A03/MF A01. Order Number DE89003425/JAW.

Individual energy group gain factors are computed for liquid nitrogen-15 and liquid deuterium cold source moderators using simple one-dimensional slab and spherical geometry calculational models. The energy spectrum of the neutron source is assumed to be that of a thermalized Maxwellian flux at 20{degree}C. The slab geometry calculations indicate that the optimum thickness for neutron transmission through a slab given an isotropic incident flux is for wavelengths above .6 nm, approximately .20 m for liquid deuterium and between .28 and .32 m for liquid nitrogen-15. The gain factors at .8 nm corresponding to these thicknesses are 15.5 for liquid deuterium and 3.50 for liquid nitrogen-15. The spherical geometry analysis showed that the cold neutron current below 10 MeV of 1.36 n/m^2-s for the neutron component entering the cavity of a .16 m thick liquid deuterium spherical shell exceeds the neutron leakage current of 1.08 n/cm^2-s from a .38 m diameter liquid deuterium solid sphere. However, the cold neutron factors for the neutron entering the void region are considerably lower than for the solid sphere case. 15 refs., 24 figs., 7 tabs.

5567 **(RAL—88-074) Neutron-electron spectroscopy: selection rules and relativistic effects.** Balcar, E.; Lovesey, S.W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). (Rutherford Appleton Lab., Chilton (UK)). Sep 1988. 5p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88756027/JAW.

Neutron scattering permits the study of transitions within and between Russell-Saunders multiplets. Applied to rare earth and actinide metals and compounds the technique provides information that is not obtained with other experimental probes. For such materials, scattering from an isolated ion is a good guide for the interpretation of data. Selection rules for this model are discussed. These are different in a relativistic treatment of atomic electron states. Work on this topic by Stassis and Deckman (1976 J. Phys. C9 2241) is clarified.

6550 Medical Physics

REFER ALSO TO CITATION(S) 4760, 5006, 5151, 5152, 5153

5568 (INIS-mf—11328, pp 52) **Fading in LiF thermoluminescence dosimeters.** Vana, N.; Schoener, W.; Schwabl, W. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5569 **(JET-R—88-05) Activation of the JET vacuum vessel: a comparison of calculated with measured gamma-radiation fluxes and dose rates.** Jarvis, O.N.; Sadler, G.; Avery, A.; Verschuur, K.A. (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking; UKAEA Atomic Energy Establishment, Winfrith; Netherlands Energy Research Foundation, Petten). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 24p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755483/JAW.

The gamma-radiation dose-rates inside the JET vacuum vessel due to induced radioactivity were measured at intervals throughout the 1986 period of operation, and the decay gamma energy spectrum was measured during the subsequent lengthy shutdown. The dose-rates were found to be in good agreement with values calculated using the neutron yield records compiled from the time-resolved neutron yield monitor responses for individual discharges. This result provides strong support for the reliability of the neutron yield monitor calibration.

5570 **(NRPB-R—219) Summary of data held by the National Registry for Radiation Workers.** Kendall, G.M.; O'Hagan, J.A.; Rees, S.; Walker, S.M.; Muirhead, C.R. (National Radiological Protection Board, Chilton (UK)). Sep 1988. 30p. H.M. Stationery Office, London, price Pound 5.00.

This report summarises the data held by the National Registry for Radiation Workers at the end of 1985. Agreement has been reached with the participating organisations for transfer of records on 97,000 individuals. However, some individuals have been employed by more than one participating organisation and a few (2%) have refused to participate, so the final study population will be somewhat smaller. Over 95% of participants have been registered and arrangements are in hand to include most of the remainder. Although some information is still outstanding, there has been a considerable improvement since the publication of the second supplement to NRPB-R116 (Protocol for the National Registry for Radiation Workers) which described the database at the end of 1983. Details are given for each of the participating organisations.

5571 (OEVS-Mitteilung—1/1988, pp 57-63) **Problems of fixing limiting values for some radionuclides.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704893/JAW. (CONF-8406372—).

From Radioecology, emissions and immissions conference; Vienna, Austria (14 Jun 1984).

The use of radioactive substances not mentioned in the Austrian Radiation Protection Ordinance leads to some administrative problems, where very restrictive limits have to be used. This is because levels not used in standards are taken, and already obsolete standards are used. Solutions are shown, based upon adoption of ICRP 30. 2 tabs.

5572 **(OUP—88-13) Biological UV-doses and the effect on an ozone layer depletion.** Dahlback, A.; Henriksen, T.; Stamnes, K. (Oslo Univ. (Norway). Fysisk Inst.; Tromsoe Univ. (Norway)). (Oslo Univ. (Norway). Fysisk Inst.). Aug 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755673/JAW.

Effective UV-doses were calculated based on the integrated product of the biological action spectrum and the solar radiation. The calculations included absorption and scattering of UV-radiation in the atmosphere, both for normal ozone conditions as well as for a depleted ozone layer. The effective annual UV-dose increases by approximately 4% per degree of latitude towards the equator. An ozone depletion of 1% increases the annual UV-dose by approximately 1% at 60/sup o/ N. A large depletion of 50% over Scandinavia (60/sup o/ N) would give this region an effective UV-dose similar to that obtained, with normal ozone conditions, at a latitude of 40/sup o/ N (California or the Mediterranean countries). The Antarctic ozone hole increases the annual UV-dose by 20 to 25% which is a similar increase as that attained by moving 5 to 6 degrees of latitude nearer the equator. The annual UV-dose on higher latitudes is mainly determined by the summer values of ozone. Both the ozone values and the effective UV-doses vary from one year to another (within +-4%). No positive or negative trend is observed for Scandinavia from 1978 to 1988.

6560 Condensed Matter Physics

REFER ALSO TO CITATION(S) 4282, 4699, 4700, 4704, 4717, 4719, 4719, 4725, 4728, 4758, 4775, 4775, 4776, 4777, 4777, 4778, 4778, 4781, 4782, 4782, 4784, 4789, 4790, 4791, 4793, 5041, 5334, 5335

5573 **(BNL—41816) Comparison of glancing angle EXAFS extracted from reflectivity and fluorescence modes.** Chen, H.; Heald, S.M. (Brookhaven National Lab., Upton, NY (USA)). 1988. Contract AC02-76CH00016;AS05-80ER10742. 3p. (CONF-8808149—4). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003615/JAW.

From 5. international conference on X-ray absorption fine structure; Seattle, WA, USA (21 Aug 1988).

EXAFS extracted from glancing angle fluorescence and reflectivity data are compared after correcting for the anomalous dispersion distortions. Preliminary results show good agreement in the information obtained from the two techniques. 3 refs., 1 fig.

5574 **(CONF-881151—35) The sputter generation of negative ion beams: Analytical modeling.** Alton, G.D. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01. Order Number DE89003112/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The secondary negative ion generation process is examined through the use of energy-dependent analytical models. Non-linear least squares fit parameters for the models are determined from fits to the experimental data of Yu. These models are used to illustrate the effect of work function on the energy distributions of negative ions sputter ejected from a polycrystalline molybdenum surface covered with fractional layers of cesium. Predictions are also made of the functional dependence of the probability for negative ion formation on cesium coverage. 33 refs., 6 figs.

5575 **(CONF-881155—7) Hopping model for the non-Debye dielectric response in ionic crystals.** Wang, J.C.; Bates, J.B. (Oak Ridge National Lab., TN (USA)). Oct 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. Order Number DE89003151/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

A model based on ion hopping in potential double-wells is proposed to explain the non-Debye dielectric response in solids. Relying on some assumptions, an attempt is made to remove the "average" nature of previous diffusion theories. This results in a distribution of activation energies, G(E), which decays exponentially on both sides of some given value E/sub o/. It is shown that the existence of a dielectric loss peak is a result of the decay of G(E) for E $> E_0$ the constant-phase-angle behavior above the loss peak is associated with the decay of G(E) for E $< E_0$, and G(E) can produce all the main features of the empirical Havriliak-Negami function. An interesting property of this G(E) is that it broadens with increasing temperature, consistent with many experimental observations. 18 refs., 3 figs.

5576 **(CONF-8706103—11) The electronic structure and the state of compositional order in metallic alloys.** Gyorffy, B.L.; Johnson, D.D.; Pinski, F.J.; Nicholson, D.M.; Stocks, G.M. (Oak Ridge National Lab., TN (USA)). 1987. Contract AC05-84OR21400. 49p. NTIS, PC A03/MF A01. Order Number DE89003147/JAW.

From NATO advanced study institute on alloy phase stability; Crete, Greece (14 Jun 1987).

Many two-component (A,B) systems crystallize into a random solid solution. In such a state the atoms occupy a more or less regular array of lattice sites but each site can be A or B in a random fashion. Then, on lowering the temperature, the system will either phase separate or order, starting at some transition temperature T/sub c/. The aim of these lectures is to present a microscopic approach to the understanding of these scientifically interesting and technologically important processes. 64 refs., 19 figs.

5577 **(CONF-8808159—1) The impact parameter dependence of swift electron-matter interactions.** Ritchie, R.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01. Order Number DE89002341/JAW.

From Summer school on spectroscopy of solid surfaces; San Sebastian, Spain (29 Aug 1988).

In quantal collision theories, momentum and energy are usually taken to be good quantal variables. Classical collision theory, on the other hand, uses position and time to describe interactions between a probe and a target. In modern physics one may wish to express quantal theories in terms of spacelike variables. For example, experiments are now common in which one measures, by means of a narrowly focused beam of swift electrons, the distribution in energy of losses experienced in a very small region of space. Also, in experiments with channeled ions, and in microdosimetry, one is interested in the spatial coherence of unlocalized excitations created by swift ions and electrons, and their ultimate localization through transfer of energy to, e.g., single-particle excitations. In this lecture the author describes work, done in part in collaboration with Professor Howie, on some aspects of the spatial dependence of inelastic interactions between a charged particle and a condensed matter target. 6 refs., 1 fig.

5578 **(CONF-8808159—2) The coupling of condensed matter excitations to electron probes.** Ritchie, R.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 16p. NTIS, PC A03/MF A01. Order Number DE89002340/JAW.

From Summer school on spectroscopy of solid surfaces; San Sebastian, Spain (29 Aug 1988).

Aspects of coupling of a classical electron with bulk and surface excitations in condensed matter have been sketched. Some considerations of a self-energy approach to the complete quantal treatment of this coupling have been given. 19 refs., 3 figs.

5579 **(CONF-8808159—3) Surface and bulk excitations in condensed matter.** Ritchie, R.H. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01. Order Number DE89002342/JAW.

From Summer school on spectroscopy of solid surfaces; San Sebastian, Spain (29 Aug 1988).

In this lecture collective and single-particle electron excitations of solids will be discussed with emphasis on the properties of metallic and semiconducting materials. However, some of the general properties of long-wavelength collective modes to be discussed are valid for insulators as well, and some considerations apply to nuclear excitations such as optical or acoustical phonons, dipolar plasmons, etc. The concept of elementary excitations in solids, pioneered by Bohm and Pines almost 4 decades ago, has proved to be extremely useful in understanding the properties of systems of many particles, especially in respect to the response to the action of external probes. 32 refs., 12 figs.

5580 **(DOE/ER/13674—2) Theoretical studies of electrons and electron transfer processes in fluids: Progress report, August 1987--September 1988.** Kestner, N.R. (Louisiana State Univ., Baton Rouge (USA). Dept. of Chemistry). 1988. Contract FG05-87ER13674. 19p. NTIS, PC A03/MF A01. Order Number DE89003259/JAW.

Research accomplished during the past year involved studies of interaction of hydrated metal ions. Studies with model potentials have demonstrated the distortion of hydration shells at high concentrations. We have also evaluated the radial distribution functions between interacting ions and have calculated the effect on electron transfer rates. It dramatically increased this rate. Research also involved studies of water-water interactions and weak intermolecular forces, in general. The role of Basis Set Superposition Error (BSSE) in limiting the accuracy of atom-atom and molecule-molecule interactions have been demonstrated. New techniques which remove the BSSE at the second order correlation level have been completed. In collaboration with Dr. S. Gupta we have studied the interaction of propane molecules and used these to evaluate liquid properties. Using Density Functional Theory a very large calculation on the iron dimer has been published; other work on the interaction of argon atoms has been completed. We have developed the pseudopotential for ammonia for Landman and Jortner and have collaborated on studies of negative ammonia clusters. We also have completed extensive work with negatively charged water dimmers. Our work on sodium water clusters which have been observed experimentally in beams has been completed. These may also be involved in photobleaching hydrated electrons. Our work on the conformation of several conducting polymer fragments has been published. We show that some helical structure exists. 3 figs.

5581 **(DOE/ER/45072—33) Scanning tunneling microscopy of atoms and charge density waves in 1T-TaS_2, 1T-$TaSe_2$ and 1T-VSe_2.** Slough, G.; Giambattista, B.; Johnson, A.; McNairy, W.W.; Coleman, R.V. (Virginia Univ., Charlottesville (USA). Dept. of Physics). [1988]. Contract FG05-84ER45072. 45p. NTIS, PC A03/MF A01. Order Number DE89003001/JAW.

The layer structure dichalcogenide materials TaS_2 and $TaSe_2$ grow in several different phases depending on the coordination between the Ta and chalcogenide atoms and the number of three layer sandwiches per unit cell. The 1T phase has octahedral coordination between the Ta and chalcogenide atoms and has one three layer sandwich per unit cell. The high temperature Fermi surfaces (FSs) of the 1T phase Ta based materials exhibit a favorable nesting condition and undergo a charge-density-wave (CDW) transition at temperatures well above room temperature. At low temperatures the CDWs form a $\sqrt{13}$ {ovr string}a {times} $\sqrt{13}$ a commensurate superlattice. STM scans on the 1T phases confirm the presence of an extremely strong CDW modulation inducing z-deflections in the constant current mode of anomalously large values. 1T-VSe_2 is also a member of the VB layer structure dichalcogenide group and band structure calculations show the high temperatures FS to be similar to that of 1T-$TaSe_2$. However, sufficient differences exist such that the CDW formation is quite different. The CDW superlattice is observed to form only below room temperature and locks into a 4{ovr string}a {times} 4{ovr string}a superlattice below {approximately}80K rather than the $\sqrt{13}$ {ovr string}a {times} $\sqrt{13}$ {ovr string}a one observed in 1T-$TaSe_2$. Based on electron and neutron diffraction results on stoichiometric 1T-VSe_2 two phase transitions are detected, a second order transition at 110K and a first order transition at {approximately}80K. 20 figs.

5582 **(DOE/ER/45130—3) [Non-empirical interatomic potentials for transition metals, alloys, and semiconductors]: Progress report.** (Washington Univ., St. Louis, MO (USA)). [1988]. Contract FG02-84ER45130. 4p. NTIS, PC A02/MF A01. Order Number DE89003344/JAW.

Our research efforts during the past year have been primarily directed at developing many-body interatomic potential descriptions of metals, containing up to four-body terms. In addition, for calibration purposes we have explored new techniques for including the three- and four-body terms in effective, state-dependent, two-body terms. 2 figs.

5583 **(DOE/ER/45236—3) Studies of melting, crystallization, and commensurate-incommensurate transitions in two dimensions: Third year progress report.** Mockler, R.C.; O'Sullivan, W.J. (Colorado Univ., Boulder (USA)). Sep 1988. Contract FG02-86ER45236. 23p. NTIS, PC A03/MF A01. Order Number DE89003253/JAW.

The free expansion melting of a 2D suspension of micron-size spheres contained between parallel silica plates has been analyzed in some detail. The translational and orientational correlation functions conform with KTHNY theory prediction of a two-step melting process. The visual observations and study of the defect structures and evolution strongly suggest the process is first order with two-phase coexistence taking the place of the intermediate (hexatic) phase. On the other hand, melting of a 2.88 μm monolayer on water is in accord with KTHNY including the observation of dislocation-pair unbinding at the first transition. However, there is no evidence of the dissociation of dislocation into free disclinations at the second transition (the defect structure is much too complex here). Dynamic light scattering experiments on a 2D crystal on the surface of water yield viscous damping factors, force constants and the Lame coefficients. 2D computer simulation, in collaboration with Noel Clark's group, reveal cooperative motion along chains of particles ("snakes"). They appear to be the principal cause of diffusion near the melting point and important in the melting process. 16 refs.

5584 (INIS-mf—11324, pp 18-19) **Moessbauer spectroscopy in material research.** Sitek, J.; Lipka, J.; Seberini, M. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5585 (INIS-mf—11324, pp 20) **Study of electronic properties of solids by Moessbauer spectroscopy: neptunium and its compounds.** Kalvius, G.M. (Technische Univ. Muenchen (Germany, F.R.)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5586 (INIS-mf—11324, pp 21) **Surface magnetism of iron studied by in situ CEMS.** Krop, K.; Korecki, J. (Akademia Gorniczo-Hutnicza, Krakow (Poland). Inst. Metalurgii). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5587 (INIS-mf—11324, pp 82) **Criterion for the efficiency of the measurement of Moessbauer spectra.** Seberini, M. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5588 (INIS-mf—11324, pp 84) **Determination of the magnetic texture of Fe-Si sheets by means of Moessbauer spectroscopy.** Schneeweiss, O.; Solyom, A.; Marko, P.; Fric, V. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie; Slovenska Akademia Vied, Kosice (Czechoslovakia). Ustav Experimentalnej Fyziky; Univerzita P.J. Safarika, Kosice (Czechoslovakia); Vychodoslovenske Zeleziarne, Kosice (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5589 (INIS-mf—11324, pp 85) **Moessbauer spectroscopy of the deformed carbon and nitrogen steels.** Gavrilyuk, V.G.; Nadutov, V.M. (AN Ukrainskoj SSR, Kiev. Inst. Mekhaniki). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5590 (INIS-mf—11324, pp 86) **Moessbauer spectroscopy of laser surface alloyed steel.** Schneeweiss, O.; Volenik, K.; Had, J.; Slesinger, R.; Forman, J. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie; Statni Vyzkumny Ustav Ochrany Materialu G.V. Akimova, Prague (Czechoslovakia); Research Institute of Iron and Steel, Karlstejn (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5591 (INIS-mf—11324, pp 87) **Laser implantation of iron into high-melting materials.** Nemoshkalenko, V.V.; Tomashevskij, N.A.; Mazanko, V.F.; Nishchenko, M.M.; Razumov, O.N. (AN Ukrainskoj SSR, Kiev. Inst. Mekhaniki). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5592 (INIS-mf—11324, pp 89) **Phase analysis of welding aerosols using Moessbauer spectroscopy.** Lipka, J.; Valko, P.; Kosnac, L.; Moerup, S.; Madsen, M.B.; Stern, R.M. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia); Vyskumny Ustav Zvaracsky, Bratislava (Czechoslovakia); Technical Univ. of Denmark, Lyngby. Inst. of Mathematical and Operations Research; The Danish Welding Institute, Broendby (Denmark)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5593 (INIS-mf—11324, pp 90) **Moessbauer spectroscopy study of Ba-hexagonal ferrites prepared by a wet method.** Lipka, J.; Gruskova, A.; Cirak, J.; Hucl, M.; Toth, I. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5594 (INIS-mf—11324, pp 91) **Moessbauer spectroscopy of iron phosphides.** Nemoshkalenko, V.V.; Tomashevskij, N.A. (AN Ukrainskoj SSR, Kiev. Inst. Mekhaniki). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5595 (INIS-mf—11324, pp 92) **Application of atomic absorption spectrometry and Moessbauer spectroscopy for analysis of impurities in synthetic diamonds.** Zemcik, T.; Sucha, A.; Macak, J.; Flasar, J. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie; Vyzkumny Ustav pro Praskovou Metalurgii, Sumperk (Czechoslovakia); Pramet, Sumperk (Czechoslovakia)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5596 (INIS-mf—11324, pp 93) **Relaxation of amorphous alloys by Moessbauer spectroscopy.** Zemcik, T. (Ceskoslovenska Akademie Ved, Brno. Ustav Fyzikalni Metalurgie). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5597 (INIS-mf—11324, pp 96) **Contribution to the fitting model for Moessbauer spectra of metallic glasses.** Miglierini, M.; Sitek, J. (Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Elektrotechnicka Fakulta). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5598 (INIS-mf—11324, pp 98) **Application of the Moessbauer spectroscopy for studies of iron coordination in silicate glasses.** Lipinska-Kalita, K.; Goerlich, E. Jr. (Uniwersytet Jagiellonski, Krakow (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5599 (INIS-mf—11324, pp 99) **Moessbauer study on disproportionation of wustite phase in the iron catalyst for ammonia synthesis.** Pattek-Janczyk, A.; Miczko, B.; Sepiol, B. (Uniwersytet Jagiellonski, Krakow (Poland); Institute of Nuclear Physics, Krakow (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5600 **(INIS-mf—11324) 8th Czechoslovak spectroscopic conference. Abstracts. Section S - special spectroscopic techniques.** (Ceskoslovenska Spektroskopicka Spolecnost, Prague). 2 Jun 1988. 162p. (CONF-8806259—). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW.

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

Volume 3 of the conference proceedings contains abstracts of 17 invited papers, 101 poster presentations and 7 papers of instrument manufacturers, devoted to special spectroscopic techniques including X-ray microanalysis, X-ray spectral analysis, Moessbauer spectrometry, mass spectrometry, instrumental activation analysis and other instrumental radioanalytical methods, electron spectrometry, and techniques of environmental analysis. Sixty abstracts were inputted in INIS. (A.K.).

5601 (INIS-mf—11324, pp 32) **Surface and interface analysis.** Bruemmer, O. (Martin-Luther-Universitaet Halle-Wittenberg, Halle (German Democratic Republic). Sektion Physik). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5602 (INIS-mf—11324, pp 33-34) **Topics in total current spectroscopy.** Skonieczny, J. (Akademia Rolnicza-Techniczo, Bydgoszcz (Poland)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5603 (INIS-mf—11324, pp 35-36) **Electron spectroscopic study of InP (100).** Zemek, J.; Chab, V. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5604 (INIS-mf—11324, pp 60) **Morphology and nondestructive concentration depth profiling of InP (100) face.** Novotna, A.; Simeckova, M.; Zemek, J. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5605 (INIS-mf—11324, pp 102) **Fast atom bombardment and collisional activation mass spectrometry of oligosaccharides related to xylans.** Kovacik, V.; Petrakova, E.; Hirsch, J.; Mihalov, V.; Heerma, W.; Versluis, C. (Slovenska Akademia Vied, Bratislava (Czechoslovakia); Rijksuniversiteit Utrecht (Netherlands)). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5606 (INIS-mf—11328, pp 38) **Determination of gas density in helium bubbles by neutron small-angle scattering.** Schwahn, D.; Quiang Li; Schroeder, H.; Ullmaier, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5607 **(INIS-mf—11819) Particle desorption of non-conducting surfaces by heavy ions of high energy.** Guthier, W. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich 5 - Physik). 10 Jul 1986. 113p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755404/JAW.

In the present thesis the desorption of non-conducting surfaces is investigated for krypton, xenon and uranium ions. Targets are europium oxide, cesium iodide, oxophenyl arsenic and manganese gluconate. (BHO).

5608 **(INIS-mf—11830) On the measurement of Compton profiles on high-nuclear-charge-number solids by inelastic proton-electron scattering.** Spies, R. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik). 3 Apr 1987. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755409/JAW.

In this thesis Compton profiles of high-nuclear-charge-number solids (silver, lutetium, gold, copper-nickel alloy) are obtained by inelastic proton-electron scattering at 21 respectively 22 MeV proton energy from the measurement of the energy spectrum of the recoil electrons in forward direction at an energy which corresponds to the double projectile velocity. For silver, lutetium, and gold from the experimental data after subtraction of a core contribution described by atomic Hartree-Fock wave function Compton profiles of the valence electrons were obtained; for the first time a valence Compton profile of gold was measured. (orig./HSI).

5609 (INIS-SU—59/A, pp 63-64) **Study of electron excitation multiplication in crystals with alkali earth cations by using synchrotron radiation.** Bel'skij, A.N.; Vasil'ev, A.N.; Kamenskikh, I.A.; Mikhajlin, V.V.; Rybakov, B.V.; Terekhin, M.A. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780006/JAW.

Voprosy atomnoj nauki i tekhniki.; no.4(40).

In General and nuclear physics. Scientific-technical collection.

5610 (INIS-SU—59/A, pp 69-70) **Calculation method of radiation characteristics for rather low energy electron channeling.** Mikheev, S.A.; Tulupov, A.V. 1987. (In Russian). NTIS (US Sales Only), PC A05/MF A01. Order Number DE89780006/JAW.

Voprosy atomnoj nauki i tekhniki.; no.4(40).

In General and nuclear physics. Scientific-technical collection.

5611 **(Juel—2185) Investigations to the dynamics of the high, low and incommensurate phases in quartz and AlPO/sub 4/ by inelastic neutron diffraction.** Bethke, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Technische Hochschule Aachen (Germany, F.R.)). Feb 1988. 195p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE88755585/JAW.

The mechanism of phase transitions of the low-quartz -> incommensurate -> high-quartz type is investigated in quartz and AlPO/sub 4/ by inelastic neutron scattering. The temperature dependence of the phonon spectra and the mode coupling have been investigated and lattice dynamical models have been developed in order to reveal a microscopic picture of the phase transitions. (BHO).

5612 **(LA-UR—88-3481) New facility for ion beam materials characterization and modification at Los Alamos.** Tesmer, J.R.; Maggiore, C.J.; Parkin, D.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 13p. (CONF-881151—22). NTIS, PC A03/MF A01 - OSTI. Order Number DE89002124/JAW.

From International conference on the application of accelerators in research and industry; Denton, TX, USA (7 Nov 1988).

The Ion Beam Materials Laboratory (IBML) is a new Los Alamos laboratory devoted to the characterization and modification of the near surfaces of materials. The primary instruments of the IBML are a tandem electrostatic accelerator, a National Electrostatics Corp. Model 9SDH, coupled with a Varian CF-3000 ion implanter. The unique organizational structure of the IBML as well as the operational characteristics of the 9SDH (after approximately 3000 h of operation) and the laboratories' research capabilities will be discussed. Examples of current research results will also be presented. 5 refs., 2 figs.

5613 **(LA-UR—88-3667) Unlubricated sliding properties of ion beam and excimer laser mixed Fe-Ti-C multilayered films.** Hirvonen, J.P.; Nastasi, M.; Jervis, T.R.; Tesmer, J.R. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-881155—10). NTIS, PC A02/MF A01. Order Number DE89003470/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

Multilayered Fe-Ti-C films consisting of eleven sublayers were vacuum deposited onto an AISI 304 stainless steel substrate and subsequently mixed using either 400 keV Xe ions or an excimer laser, operating at a wavelength of 308 nm. Ion mixing was accomplished in a two step process: the multilayers were first irradiated

with 1 {times} 10^{17} Xe/cm^2 at 520 C, after which half of the sample was irradiated with 5 {times}10^{15} Xe/cm^2 at O C. Laser mixing was carried out at both 1.1 and 1.7 J/cm^2 with the number of pulses varied between 1 and 10. Pin-on-disc studies revealed only slight differences between the two kinds of ion beam mixed samples, whereas the dry sliding properties of laser mixed samples were strongly dependent on the total fluence used. In the optimum conditions similar friction coefficients were obtained on both kinds of samples. 13 refs., 4 figs.

5614 **(LA-UR—88-3885) Prediction and design of first super-strong mostly-rigid polymers from very molecular theories for smectic and nematic polymers.** Dowell, F. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 15p. (CONF-881155—11). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003561/JAW.

From Fall meeting of the Materials Research Society; Boston, MA, USA (28 Nov 1988).

This paper presents a new unique microscopic molecular theory for backbone liquid-crystalline polymers (LCPs), side-chain LCPs, and combined LCPs in the nematic (N) and multiple smectic-A (SA) LC phases and the isotropic (I) liquid phase. There are no ad hoc or arbitrarily adjustable parameters in this theory. The agreement between the theoretical and experimental values for various thermodynamic and molecular ordering properties for existing LCPs is very good (relative deviations between 0% and less than 6.2%). This theory has been used by this author to predict and design (atom by atom, bond by bond) the first super-strong (SS) LCPs. This paper presents the design of SS mostly-rigid (MR) LCPs. 22 refs., 3 figs., 4 tabs.

5615 **(LBL—25708) Hydrogen-related effects in crystalline semiconductors.** Haller, E.E. (Lawrence Berkeley Lab., CA (USA)). Aug 1988. Contract AC03-76SF00098. 14p. (CONF-8808163—1). NTIS, PC A03/MF A01. Order Number DE89002954/JAW.

From 3. international conference on shallow impurities in semiconductors; Linkoping, Sweden (10 Aug 1988).

Recent experimental and theoretical information regarding the states of hydrogen in crystalline semiconductors is reviewed. The abundance of results illustrates that hydrogen does not preferentially occupy a few specific lattice sites but that it binds to native defects and impurities, forming a large variety of neutral and electrically active complexes. The study of hydrogen passivated shallow acceptors and donors and of partially passivated multivalent acceptors has yielded information on the electronic and real space structure and on the chemical composition of these complexes. Infrared spectroscopy, ion channeling, hydrogen isotope substitution and electric field drift experiments have shown that both static trigonal complexes as well as centers with tunneling hydrogen exist. Total energy calculations indicate that the charge state of the hydrogen ion which leads to passivation dominates, i.e., H^+ in p-type and H/sup {minus}/ in n-type crystals. Recent theoretical calculations indicate that is unlikely for a large fraction of the atomic hydrogen to exist in its neutral state, a result which is consistent with the total absence of any Electron Paramagnetic Resonance (EPR) signal. An alternative explanation for this result is the formation of H_2. Despite the numerous experimental and theoretical results on hydrogen-related effects in Ge and Si there remains a wealth of interesting physics to be explored, especially in compound and alloy semiconductors. 6 refs., 6 figs.

5616 **(UCRL—99709) Cherenkov x rays: Recent experimental results.** Moran, M.J.; Schneider, M.B.; Chang, B.; Maruyama, X.K. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1988. Contract W-7405-ENG-48. 12p. (CONF-8804141—6). NTIS, PC A03/MF A01. Order Number DE89002878/JAW.

From 11. Werner Brandt workshop on penetration phenomena of charged particles in matter; Oak Ridge, TN, USA (14 Apr 1988).

Preliminary experimental results show the measurement of Cherenkov x rays for silicon and carbon foils. The measured distributions demonstrate grazing-angle enhancement of the emission flux, where relativistic electrons are incident on the foils at near-grazing angles. This behavior was predicted in a paper presented at the preceding Werner Brandt Workshop. 7 refs., 3 figs.

5617 **Theory of polymer ablation.** Mahan, G.D.; Cole, H.S.; Liu, Y.S.; Philipp, H.R. (Department of Physics, University of Tennessee, Knoxville, Tennessee 37996, and Solid State Division, Oak Ridge National Laboratory, P. O. Box 2008, Oak Ridge, Tennessee 37831-6030). *Applied Physics Letters;* **53**: No. 24, 2377-2379(12 Dec 1988).

A new formula is presented for the etch depth l per pulse of an excimer laser of fluence F. Incremental ablation is defined as the etch depth per pulse after many pulses. We show that l is proportional to F, rather than ln(F).

5618 **Observation of positronium specular reflection from LiF.** Weber, M.H.; Tang, S.; Berko, S.; Brown, B.L.; Canter, K.F.; Lynn, K.G.; Mills A.P. Jr.; Roellig, L.O.; Viescas, A.J. (City University of New York, New York, New York 10036). *Physical Review Letters;* **61**: No. 22, 2542-2545(28 Nov 1988).

A monoenergetic positronium (Ps) beam of 0—60-eV energy and an angular width of +- 5° is created by charge-exchange collisions of a slow positron beam passing through an Ar gas cell. The Ps beam is directed at a LiF(100) crystal, and reflected Ps atoms are detected at an annihilation target. With angles of incidence of 50° to 60° we observe a specularly reflected beam with a maximum reflected fraction R = (30 +- 5)% at a Ps energy of 7 eV. At higher energies (20—60 eV) the reflectivity (R = 0.5% at 60 eV) can be ascribed principally to a short Ps mean free path λ = (0.75 +- 0.15) A, and to a lesser extent a Ps inner potential of about 4 eV.

6561 Superconductivity

REFER ALSO TO CITATION(S) 4707, 4735, 4736, 4741, 4742, 4743, 4744, 4745, 4842

5619 **(CONF-880812—24) RF properties of high-T/sub c/ superconductors.** Bohn, C.L.; Delayen, J.R.; Dos Santos, D.I.; Lanagan, M.T.; Shepard, K.W. (Argonne National Lab., IL (USA)). [1988]. Contract W-31109-ENG-38. 5p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003642/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We have investigated the rf properties of high-T/sub c/ superconductors over a wide range of temperature, frequency, and rf field amplitude. We have tested both bulk polycrystalline samples and thick films on silver substrates. At 150 MHz and 4.2 K, we have measured a surface resistance of 18 μ/sup {OMEGA}/ at low rf field and 3.6 m/sup {OMEGA}/ at an rf field of 270 gauss. All samples showed a strong dependence of the surface resistance on rf field; however, no breakdown of the superconducting state has been observed up to the highest field achieved (320 gauss). 9 refs., 4 figs., 1 tab.

5620 **(CONF-880812—27) RF electromagnetic investigation of an $YBa_2Cu_3O_7$ thin film by proximity coupling.** Baum, H.P.; Schenstrom, A.; Zheng, Y.; Sarma, B.K.; Levy, M.; Kang, J.H.; Kampwirth, R.T. (Wisconsin Univ., Milwaukee (USA). Dept. of Physics; Argonne National Lab., IL (USA)). 1988. Contract W-31109-ENG-38. 4p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003941/JAW.

From Applied superconductivity conference; San Francisco, CA, USA (21 Aug 1988).

We report here an investigation of the RF electromagnetic (e-m) attenuation by a $YBa_2Cu_3O_7$ thin film at 1 GHz, as a function of temperature. An increase in the RF e-m attenuation was observed as the temperature was decreased below the superconducting transition temperature T/sub c/ $\cong$ 84 K, followed by a rapid decrease at lower temperature ({approximately}25K). A theoretical analysis of e-m absorption due to Fibich is evoked to compare it with the experimental results. 9 refs., 5 figs.

5621 **(CONF-8805223—1) On positron annihilation in concentrated random alloys and superconducting cuprates.** Szotek, Z.; Temmerman, W.M.; Gyorffy, B.L.; Stocks, G.M. (Oak Ridge National Lab., TN (USA); Daresbury Lab. (UK); Bristol Univ. (UK). H.H. Wills Physics Lab.). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01. Order Number DE89002346/JAW.

From 20. Polish seminar on positron annihilation; Piechowice, Poland (15 May 1988).

We discuss an application of a generalisation of the Lock-Crisp-West theorem to concentrated random alloys. Using a theory developed for binary random alloys we explore a possibility of positron localisation in the new high temperature superconductors. 7 refs., 1 fig.

5622 (INIS-mf—11328, pp 12) **On the theory of the novel high-T/sub c/ superconductors.** Weber, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Festkoerperphysik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5623 (INIS-mf—11328, pp 30) **Quasiparticles in the flux line lattice.** Klein, U. (Johannes Kepler Univ. Linz, Institut fuer Theoretische Physik, A-4040 Linz (Austria)). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5624 **Inhibition of strong-coupling superconductivity by magnetic impurities: A quantum Monte Carlo study.** Jarrell, M. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). *Physical Review Letters;* **61**: No. 22, 2612-2615(28 Nov 1988).

The first exact calculation of (partialT/sub c//partialc)/sub c //sub = /$_0$, the initial depression of the superconducting T/sub c/, due to a small concentration, c, of magnetic impurities is presented. (partialT/sub c//partialc)/sub c //sub = /$_0$ has been calculated from the pair-breaking regime (T/sub K//T/sub co/$<<1$) where the impurities are magnetic, to the pair-weakening regime (T/sub K//T/sub c0/$>>1$). I find that (partialT/sub c//partialc)/sub c //sub = /$_0$ can be expressed as the product of two universal functions f(λ_0) and g(T/sub K//T/sub c0/), and that, in contrast to previous results, the maximum chemical bond(partialT/sub c//partialc)/sub c //sub = /$_0$chemical bond occurs when T/sub c/$_0$ = T/sub K/, thus resolving a long-standing experimental puzzle.

6570 Theoretical And Mathematical Physics

REFER ALSO TO CITATION(S) 4909, 5324, 5490, 5730

5625 **(CEA-CONF—9462) Positive exact 2+1 dimensional solutions for discrete Boltzmann models.** Cornille, H. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Theorique). 1988. 3p. (CONF-880781—). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755331/JAW.

From 16. international symposium on rarefied gas dynamics; Pasadena, CA, USA (11 Jul 1988).

We have constructed 2+1 dimensional exact solutions (space x, y time t) for three models: i) the square velocity model and the cubic model (with eight velocities oriented towards the eight corners) which satisfy the same type of nonlinear equations, ii) the Broadwell model. The main difficulty is the positivity condition N/sub i/>0 for the densities N/sub i/. We have obtained three classes of exact solutions: i) densities relaxing towards noniform Maxwellians ii) shock wave iii) semi-periodic solutions.

5626 **(DOE/ER/25033—2) Applied mathematics of transport theory: Progress report, November 15, 1987--October 15, 1988.** Greenberg, W.; Zweifel, P.F. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Center for Transport Theory and Mathematical Physics). 15 Oct 1988. Contract FG05-87ER25033. 10p. NTIS, PC A02/MF A01. Order Number DE89003372/JAW.

We are pleased to be able to report significant progress in a number of areas of research, which we discuss under the headings Nonlinear Kinetic Equations and Linear Theory.

5627 (INIS-mf—11328, pp 63) **Dynamic entropy and entropic dimension in quantum systems.** Benatti, F.; Hudetz, T.; Narnhofer, H.; Thirring, W. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5628 (INIS-mf—11328, pp 77) **Fermions interacting with time-dependent external fields.** Falkensteiner, P.; Grosse, H. (Vienna Univ. (Austria). Inst. fuer Theoretische Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5629 **(LA—11043) A theory of sequential fragmentation and its astronomical applications.** Brown, W.K. (Los Alamos National Lab., NM (USA)). Nov 1988. Contract W-7405-ENG-36. 25p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89004141/JAW.

This report presents a theory of sequential fragmentation that describes a cascade of fragmentation and refragmentation, i.e., continued comminution. The theory reproduces one of the two major empirical descriptors that have traditionally been used to describe the mass distributions from fragmentation experiments. Additional experimental evidence, including explosive aerosolization, grinding in a ball mill, and simulated volcanic action, further validates the theory. The report also presents some astronomical applications of the theory, including infalling extraterrestrial material, siderophile concentrations in black magnetic spherules of possible meteoritic origin, the asteroids, the distribution of galactic masses, and the initial mass function of stars. 49 refs., 14 figs., 1 tab.

5630 **(LA—11416-MS) Center of buoyancy definition.** Sandberg, V. (Los Alamos National Lab., NM (USA)). Dec 1988. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01. Order Number DE89003017/JAW.

The center of buoyancy of an arbitrary shaped body is defined in analogy to the center of gravity. The definitions of the buoyant force and center of buoyancy in terms of integrals over the area of the body are converted to volume integrals and shown to have simple intuitive interpretations.

5631 **(LA-UR—88-3402) Gravity in Greenland.** Hughes, R.J.; Goldman, T.; Nieto, M.M. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8808145—5). NTIS, PC A02/MF A01. Order Number DE89002239/JAW.

From Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, CT, USA (15 Aug 1988).

Preliminary results of the test of the Newtonian Law of Gravitation conducted by Ander et al., in a borehole in the Greenland ice-cap were reported at this meeting. In this paper we consider the interpretations of these results in terms of a non-Newtonian component of gravity, and compare them with the results of other geophysical inverse-square law tests. 8 refs.

5632 **(NBI-HE—88-53) On removing Berry's phase.** Giavarini, G.; Gozzi, E.; Rohrlich, D.; Thacker, W.D. (Parma Univ. (Italy). Dipt. di Fisica; Istituto Nazionale di Fisica Nucleare, Parma (Italy); European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Kaiserslautern Univ. (Germany, F.R.). Fachbereich Physik). (Niels Bohr Inst., Copenhagen (Denmark); European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Kaiserslautern Univ. (Germany, F.R.). Fachbereich Physik). Aug 1988. 9p. (CERN-TH—5139/88). NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755691/JAW.

The Berry phase can always be cancelled by a unitary transformation if the space of external parameters is appropriately restricted. But it simply reappears as part of the dynamical phase, and this shift can be regarded as a gauge transformation. The overall extra phase measured in experiments is unambiguous, and retains its geometrical character.

5633 **(NBI-HE—88-54) Some connections between classical and quantum anholonomy.** Giavarini, G.; Gozzi, E.; Rohrlich, D.; Thacker, W.D. (Istituto Nazionale di Fisica Nucleare, Parma (Italy); Parma Univ. (Italy). Dipt. di Fisica; European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Kaiserslautern Univ. (Germany, F.R.). Fachbereich Physik). (Niels Bohr Inst., Copenhagen (Denmark); European Organization for Nuclear Research, Geneva (Switzerland); Niels Bohr Inst., Copenhagen (Denmark); Kaiserslautern Univ. (Germany, F.R.). Fachbereich Physik). Aug 1988. 21p. (CERN-TH—5140/88). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755692/JAW.

In this paper we study the interplay between the classical and quantum anholonomy effects (Hannay's angle and Berry's phase). When a finite-dimensional quantum system has a Berry phase, it has a nonzero Hannay angle. We show how infinite-dimensional systems can evade this correspondence, and find some necessary conditions for a system with a Berry phase to have no Hannay angle.

5634 **(NORDITA—88/30-P(prepr.)) Approach to quantization of constrained systems.** Marinov, M.S. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark); Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics; Nordisk Inst. for Teoretisk Atomfysik, Copenhagen (Denmark)). 1988. 13p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755697/JAW.

Classical dynamical system in the Euclidean phase space, specified with a (primary) Hamiltonian H/sub 0/(q,p) and a number of constraint functions phi/sub k/(q,p) is described equivalently by means of a new Hamiltonian H(q,p) which is an invariant of the (closed) Poisson-bracket Lie algebra (H/sub 0/, phi/sub k/). The quantization is straightforward; it is given by the Heisenberg commutation relations in the embedding space. Values of a number of (commuting) constraint operators are fixed by initial conditions, while H itself does not bear an information on specific eigen-values of the constraint operators. In general, the system states are not pure and must be described in terms of the density operator (or corresponding Wigner phase-space distribution). Systems with Bose and Fermi degrees of freedom (and constraints) can be treated universally. The time evolution of the system can be represented by means of the phase-space path integral. Simple examples provide with illustrations to the general scheme.

5635 **(NP—9770054) Numerical solution of the generalized Laplace equation by coupling boundary element and perturbation methods.** Rangogni, R. (Ente Nazionale per l'Energia Elettrica, Milan (Italy)). Mar 1986. 16p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770054/JAW.

The Boundary Element Method (BEM) has, in general, some advantages with respect to domain methods, in so far as no internal discretization of the domain is required. However, such an advantage is lost if BEM is used directly for the numerical solution of the Generalized Laplace Equation (GLE). In this paper, it is shown that the GLE can also be dealt with advantageously by coupling BEM with the Perturbation Method (PM). The technique to achieve this consists in transforming the starting GLE into an equation without first partial derivatives and then solving a few problems by BEM. The technique requires an internal network but the unknowns are only on the boundary. The procedure is applied to solve numerically two test problems with known analytical solutions.

5636 **(SLAC-PUB—4528) An essay on discrete foundations for physics.** Noyes, H.P.; McGoveran, D.O. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jul 1988. Contract AC03-76SF00515. 49p. (CONF-8709318—4). NTIS, PC A03. Order Number DE89002992/JAW.

From 9. annual international meeting of the Alternative Natural Philosophy Association; Cambridge, UK (23 Sep 1987).

We base our theory of physics and cosmology on the five principles of finiteness, discreteness, finite computability, absolute non-uniqueness, and strict construction. Our modeling methodology starts from the current practice of physics, constructs a self-consistent representation based on the ordering operator calculus and provides rules of correspondence that allow us to test the theory by experiment. We use program universe to construct a growing collection of bit strings whose initial portions (labels) provide the quantum numbers that are conserved in the events defined by the construction. The labels are followed by content strings which are used to construct event-based finite and discrete coordinates. On general grounds such a theory has a limiting velocity, and positions and velocities do not commute. We therefore reconcile quantum mechanics with relativity at an appropriately fundamental stage in the construction. We show that events in different coordinate systems are connected by the appropriate finite and discrete version of the Lorentz transformation, that 3-momentum is conserved in events, and that this conservation law is the same as the requirement that different paths can "interfere" only when they differ by an integral number of deBroglie wavelengths. 38 refs., 12 figs., 3 tabs.

5637 **(UCRL—99700) X-ray conversion physics.** Kauffman, R.L.; Kania, D.R.; Langer, S.; Kornblum, H.; Ze, F. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 3p. (CONF-881056—8). NTIS, PC A02/MF A01. Order Number DE89002899/JAW.

From 19. European conference on laser interaction with matter (ECLIM); Madrid, Spain (3 Oct 1988).

We have performed a series of experiments to study the physics of the conversion of 0.35-μm laser light to soft x-rays in high-Z materials. The efficiency of soft x-ray and M-band radiation production as a function of laser intensity (5 {times} 10^{13} to 3 {times} 10^{15} W/cm^2) was measured. At fixed intensity 5 {times} 10^{14} W/cm^2, the time-resolved and time-integrated thermal x-ray ($E < 1.5$ keV) conversion efficiency increased with the laser pulse length for up to 4-ns-long pulses on gold targets. The effects of material opacity were examined by making targets of mixtures of gold and beryllium to vary the density of the strongly radiating gold in the target. These experiments demonstrate the effects of material opacity on both thermal and M-band x-ray production. These experiments were performed with large laser spots and greater than 1 kj of 0.35-μm laser light using the Nova laser. These experiments have expanded our understanding of our ability to computer model the interaction of high intensity laser light with high-Z plasmas. 5 refs., 4 figs

5638 **Method of images and electrostatic screening by a polarized dielectric sphere.** Van Siclen, C.D. (Idaho National Engineering Laboratory, P.O. Box 1625, Idaho Falls, Idaho 83415). *American Journal of Physics;* **56**: No. 12, 1142-1143(Dec 1988).

The electrostatic potential due to a point charge outside a polarized dielectric sphere is calculated by considering the analagous situation for a conducting sphere. (AIP)

5639 **Constraints on proposed spin-0 and spin-1 partners of the graviton.** Stubbs, C.W.; Adelberger, E.G.; Gregory, E.C. (Department of Physics, FM-15, University of Washington, Seattle, Washington, 98195). *Physical Review Letters;* **61**: No. 21, 2409-2411(21 Nov 1988).

Existing data from our Eoet-Wash torsion-balance experiment constrain Goldman, Hughes, and Nieto's quantum-gravity prediction that ordinary matter should feel, in addition to Newtonian gravity, composition-dependent attractive and repulsive Yukawa interactions. The Eoet-Wash null result tightly restricts the difference between the ranges of the proposed attractive and repulsive interactions. In particular, we show that the attractive and repulsive forces deduced from studies of the Earth's gravity do not exhibit the expected composition dependence.

5640 **Phenomenological aspects of new gravitational forces. IV. New terrestrial experiments.** Nieto, M.M.; Goldman, T.; Hughes, R.J. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **38**: No. 10, 2937-2943(15 Nov 1988).

We use the formalism of spin-1 (graviphoton) and spin-0 (graviscalar) partners of the graviton developed in this series to analyze four terrestrial experiments. This analysis is aided by the results of Stacey, Tuck, and Moore of Australian mine data, which allow interaction ranges up to 450 km. We find that an anomalous result of order 10% could occur for the gravitational acceleration of antimatter. Such ranges could also explain the apparently contradictory results of the Brookhaven and Washington Eoetvoes experiments in terms of the local geology. In the appendixes we rule out two other possibilities. The first would perform a gravity measurement inside a spherical shell: a "Gauss's law" test. The second would be a new rotating-disk Cavendish experiment.

5641 (JINR—D-1,2-86-668-Vol.1, pp 222-226) **Distribution functions of order parameters in temperature phase transitions in lattice.** Zadorozhnyj, A.M.; Mitryushkin, V.K. 1987. (In Russian). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW. (CONF-8606164—).

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The method of studying temperature transitions from a confinement phase to the quark-gluon plasma phase based on plotting functions of order parameters distribution is developed. The method permits to obtain the values of critical temperature Q/sub c/ susceptibility chi with high reliability. This approach proved rather effective when studying the properties of the Ising model. Calculations are made within the theory with S4(2) symmetry group but the method can also be used in theories with SU(3) symmetry group. 11 refs.; 3 figs.

5642 **(JINR—D-1,2-86-668-Vol.1) Multiquark interactions and quantum chromodynamics. Vol. 1. Proceedings of the 8. International seminar on high energy physics problems.** (Joint Inst. for Nuclear Research, Dubna (USSR)). 1987. 432p. (In Russian). (CONF-8606164—). NTIS (US Sales Only), PC A19/MF A01. Order Number DE89780026/JAW.

From 8. international seminar on high energy physics problems; Dubna, USSR (19 Jun 1986).

The 8th International Seminar on High Energy Physics was held at Dubna, USSR, June 19, 1986. The meeting dealt with multiquark interactions and quantum chromodynamics. 39 papers have been entered individually into EDB and ERA. (LTN)

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5643 **(CONF-860665—22) Modified betatron for ion beam fusion.** Rostoker, N.; Fisher, A. (California Univ., Irvine (USA). Dept. of Physics). 1986. Contract AS03-80ER53101. 5p. NTIS, PC A02/MF A01. Order Number DE89002984/JAW.

From 6. international conference on high power particle beams; Kobe, Japan (9 Jun 1986).

An intense neutralized ion beam can be injected and trapped in magnetic mirror or tokamak geometry. The details of the process involve beam polarization so that the beam crosses the fringing fields without deflection and draining the polarization when the beam reaches the plasma. Equilibrium requires that a large betatron field be added in tokamak geometry. In mirror geometry a toroidal field must be added by means of a current along the mirror axis. In either case, the geometry becomes that of the modified betatron which has been studied experimentally and theoretically in recent years. We consider beams of d and t ions with a mean energy of 500 kev and a temperature of about 50 kev. The plasma may be a proton plasma with cold ions. It is only necessary for beam trapping or to carry currents. The ion energy for slowing down is initially 500 kev and thermonuclear reactions depend only on the beam temperature of 50 kev which changes very slowly. This new configuration for magnetic confinement fusion leads to an energy gain of 10--20 for d-t reactions whereas previous studies of beam target interaction predicted a maximum energy gain of 3--4. The high beam energy available with pulsed ion diode technology is also essential for advanced fuels. 16 refs., 3 figs.

5644 **(CONF-880929—7) Lower hybrid waves for current drive and heating in reactors.** Yugo, J.; Bernabei, S.; Bonoli, P.; Devoto, R.S.; Fenstermacher, M.; Porkolab, M.; Stevens, J. (Oak Ridge National Lab., TN (USA)). [1988]. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01. Order Number DE89003150/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

Lower hybrid (LH) waves are projected to be an important ingredient for current drive and heating in steady-state operation of reactors, such as the International Thermonuclear Experimental Reactor (ITER) or later power producing tokamaks. We have examined the required frequency and spectrum for such applications and designed a system to meet the specifications. We found that, to avoid damping of LH waves on alpha particles the frequency should be at least 6--8 GHz. At a typical volume average temperature of 14 keV, the LH rays penetrate about 30% of the minor radius, or to about 15 KeV, when N/sub parallel/ is chosen to maximize penetration and the spectral width, ΔN/sub parallel/ is about 0.05 (full width at 0.5 of spectral peak). For use in low density current ramp-up and transformer recharging, N/sub parallel/ is dynamically controlled. We have designed an LH system that satisfies requirements similar to those expected for ITER. It provides a Brambilla array which can be tuned from N/sub parallel/ of 1.0--2.8. An analysis has been performed to evaluate nuclear (1--2 MW/m^2), plasma radiation, and rf heating of the LH launcher. 4 refs., 3 figs., 4 tabs.

5645 **(DOE/ER/51109—2) Studies of plasma edge density using Li-beam on ASDEX: Final technical progress report, 1985--1988.** Pietrzyk, Z.A. (Washington Univ., Seattle (USA). Dept. of Aerospace and Energetics Research). 1988. Contract FG06-87ER51109. 38p. (UWAERP—18). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003540/JAW.

This summary of OH discharges serves as a guideline for comparison of NI heated discharges of the L-mode kind, which in turn will give a basis for the analysis of H-mode discharges. Unfortunately, the plasma edge in ASDEX with the new divertor configuration does not show this simple dependence of edge parameters,

and the separatrix density and the fall-off length depends on more parameters, one of which is the dn/sub e//dt. We had limited time to study this kind of discharge, so there are many unanswered questions. A more detailed description of new divertor discharges will be given later in this report. An addition is appropriate here, which concern a series of OH heated discharges that show quantitatively different behavior, having either a larger λ or a lower coefficient of proportionality between n/sub s/ and {tilde n}/sub e/. These shots are not described in the published papers as we could not determine under which discharge conditions they occurred. The dependence of n/sub s/ on n/sub e/ is particularly important; in cases with a lack of Thomson scattering data we used separatrix density calculated from {tilde n}/sub e/ for calibration. This, unfortunately, was frequently the case as the ruby Thomson scattering system was often out of order. Similar behavior was observed again in new divertor configuration. In this report we will concentrate mainly on NI heated discharges. 4 ref., 23 figs.

5646 **(DOE/ER/53218—7) Current fusion plasma theory grant: Task I, Magnetic confinement fusion plasma theory: Final report, December 1, 1987--November 14, 1988.** Callen, J.D. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering and Engineering Physics). Jul 1988. Contract FG02-86ER53218. 16p. NTIS, PC A03/MF A01. Order Number DE89003255/JAW.

The research performed under this grant over the current 11-1/2 month period has concentrated on key tokamak plasma confinement and heating theory issues: extensions of neoclassical MHD; viscosity coefficients and transport; nonlinear resistive MHD simulations of Tokapole II plasmas; ICRF and edge plasma interactions; energy confinement degradation due to macroscopic phenomena; and coordination of a new transport initiative. Progress and publications in these areas are briefly summarized in this report. 21 refs.

5647 **(DOE/ER/53218—9) Fusion plasma theory: Task III, Auxiliary heating in tokamaks: Final report.** Scharer, J.E. (Wisconsin Univ., Madison (USA). Dept. of Electrical and Computer Engineering). Jul 1988. Contract FG02-86ER53218. 14p. NTIS, PC A03/MF A01. Order Number DE89003256/JAW.

The research we have accomplished during the past three year period includes the topics of ICRF fast wave coupling to L- and H-mode edge profiles and coupled full wave ICRF field solutions for CIT and TFTR supershots. We have also developed Quasi-linear Fokker-Planck codes to model nonlocal wave reflection, mode conversion, wave deposition and simulation of core sawtooth phenomena for large tokamaks such as JET. We have also examined coupling between launched fast waves and ion Bernstein waves driven by density gradients near the plasma edge and the effects of known edge turbulence and ponderomotive effects on the direct launching of ion Bernstein waves. We find that a TE_{10} ICRF fast mode waveguide launcher only has a moderate increase in its reflection coefficient when coupling into a model H-mode plasma density profile. Our full wave 1-D ICRF code results have corrected earlier formulations by other authors and described a method for calculation of wave fields with an evanescent ion Bernstein mode. The results show that wave reflections, minority and majority absorption and mode conversion are sensitive to plasma and wave parameters and yield stronger minority and majority than a WKB formulation would yield. We have coupled the wave heating code to a Fokker-Planck code to model strong electron sawtooth phenomena occurring during minority hydrogen heating on JET. We find that fast ion tail formation and electron drag heating rather than direct electron heating or electron heating via mode conversion to ion Bernstein waves play an important role in core plasma sawtooth dynamics. We find that linear coupling from fast modes to ion Bernstein modes occurs due to larger density gradient scale lengths near the plasma edge. 8 refs., 1 tab.

5648 **(DOE/ER/53227—129) Magnetic turbulence and resistive MHD instabilities in a 0.6 < q < 3 poloidal divertor tokamak.** Agim, Y.Z.; Callen, J.D.; Chang, Z.; Dexter, R.N.; Goetz, J.A.; Graessle, D.E.; Haines, E.; Kortbawi, D.; LaPointe, M.A.; Moyer, R.A. (Wisconsin Univ., Madison (USA). Plasma Physics Research; International Atomic Energy Agency, Vienna (Austria)). Sep 1988. Contract FG02-86ER53227. 7p. (IAEA-CN—50/A-7-5; CONF-881015—27). NTIS, PC A02/MF A01. Order Number DE89002828/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Detailed statistical properties of internal magnetic turbulence, and internal disruptions in magnetically- and materially-limited discharges, are studied in the Tokapole II poloidal divertor tokamak over the safety factor range 0.6 < q/sub a/ < 3. A nonlinear MHD code treats tearing modes in the divertor geometry. 9 refs., 2 figs.

5649 **(ENEA-RT-FUS—87-30) Kinetic theory of drift waves.** Vlad, G. (ENEA, Rome (Italy)). Apr 1988. 108p. (In Italian). NTIS (US Sales Only), PC A06. Order Number DE88755366/JAW.

The linear stability of the electrostatic drift waves in slab geometry was studied both analytically and numerically. The effects of a magnetic field with shear, of the finite Larmor radius, of electron streaming, of a temperature gradient and of the collisions were retained. The analytical solution was then obtained by the use of the matched asymptotic expansion technique, and an expression for the critical streaming parameter was derived. Finally, assuming that the transport in the Reversed Field Pinches is dominated by this instability, a scaling law for the temperature in such machine was established.

5650 **(EUR—11596-EN) Jet Joint Undertaking. Annual report 1987.** Keen, B.E.; O'Hara, G.W.; Pollard, I.E. (eds.). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). Jul 1988. 57p. (EUR-JET-AR—10). NTIS (US Sales Only), PC A04/MF A01. Order Number DE88755481/JAW.

The paper presents the Jet Joint Undertaking annual report 1987. A description is given of the JET and Euratom and International Fusion Programmes. The technical status of JET is outlined, including the development and improvements made to the system in 1987. The results of JET Operation in 1987 are described within the areas of: density effects, temperature improvements, energy confinement studies and other material effects. The contents also contain a summary of the future programme of JET. (U.K.).

5651 **(GA-A—19388) Theoretical models for tokamak ignition projections.** Waltz, R.E.; Dominguez, R.R.; Perkins, F.W.; Wiley, J.C.; Miner, W.H.; Ross, D.W.; Terry, P.W.; Valanju, P.M.; Diamond, P.H.; Sheffield, J. (General Atomic Co., San Diego, CA (USA)). Oct 1988. Contract AC03-84ER53158;AC02-76CH03073;AC05-84OR21400;FG05-88ER53266. 15p. (CONF-881015—30). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003404/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Theoretical transport models derived from interior drift modes can provide a useful basis for ignition projections when modified to account for the poorly understood edge mechanisms. These projections stimulate re-interpretation and experimental re-examination of commonly used empirical models and of the theoretical models themselves. 11 refs., 2 figs., 2 tabs.

5652 **(GA-A—19435) Ion Bernstein Wave antenna design for DIII-D.** Phelps, R.D.; Mayberry, M.J.; Pinsker, R.I. (General Atomics Co., San Diego, CA (USA)). Sep 1988. Contract AC03-84ER51044. 6p. (CONF-880929—8). NTIS, PC A02/MF A01. Order Number DE89003135/JAW.

From 15. symposium on fusion technology; Utrecht, Netherlands (19 Sep 1988).

An array of two toroidal loop antennas has been designed and installed on the DIII-D tokamak to carry out Ion Bernstein Wave (IBW) heating experiments. The antenna will operate at the 2 MW level and provide direct excitation of the IBW over the frequency range of 30--60 MHz. This device will permit the study of coupling the IBW to divertor plasmas and will provide a means for improving the confinement and stability of high beta plasmas through localized off-axis heating. This paper describes both the mechanical and electromagnetic design of the IBW antenna. 2 refs., 4 figs., 1 tab.

5653 **(IAEA-CN—50/D-II-1) Neoclassical MHD descriptions of tokamak plasmas.** Callen, J.D.; Kim, Y.B.; Sundaram, A.K.; Carreras, B.A.; Garcia, L.; Shaing, K.C.; Spong, D.A.; Biglari, H.; Diamond, P.H.; Kwon, O.J. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400;FG02-86ER53218;FG03-88ER53275. 8p. (CONF-881015—28). NTIS, PC A02/MF A01. Order Number DE89003117/JAW.

From 12. international conference on plasma physics and controlled nuclear fusion research; Nice, France (12 Oct 1988).

Considerable progress has been made in extending neoclassical MHD theory and in exploring the linear instabilities, nonlinear behavior and turbulence models it implies for tokamak plasmas. The areas highlighted in this paper include: extension of the neoclassical MHD equations to include temperature-gradient and heat flow effects; the free energy and entropy evolution implied by this more complete description; a proper ballooning mode formalism analysis of the linear instabilities; a new rippling mode type instability; numerical simulation of the linear instabilities which exhibit a smooth transition from resistive ballooning modes at high collisionality to neoclassical MHD modes at low collisionality; numerical simulation of the nonlinear growth of a single helicity tearing mode; and a Direct-Interaction-Approximation model of neoclassical MHD turbulence and the anomalous transport it induces which substantially improves upon previous mixing length model estimates. 34 refs., 2 figs.

5654 (INIS-mf—11324, pp 73) **Choice of spectroscopic scheme in X-ray plasma diagnostics.** Renner, O.; Kopecky, M. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav). 2 Jun 1988. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704801/JAW. (CONF-8806259—).

From 8. Czechoslovak spectroscopic conference; Ceske Budejovice, Czechoslovakia (19 Jun 1988).

5655 (INIS-mf—11328, pp 50) **Atomic impact processes for the diagnostic and the balance of Tokamak.** Aumayr, F.; Schneider, M.; Schweinzer, J.; Winter, H. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5656 (INIS-mf—11328, pp 50) **Neoclassical diffusion of alpha particles.** Kamelander, G. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Inst. fuer Energie- und Anlagentechnik). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5657 **(INIS-mf—11826) IPF annual report 1987.** (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). 1988. 20p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755406/JAW.

The cooperation between IPP and IPF in the field of fusion related research and development has been successfully continued. The ECRH-activities were mainly concentrated on the construction of the 70 GHz-facility for the W VII-AS-stellarator and the development of new components for the transmission and measurement of millimetre waves. Theoretical calculations have been concerned with numerical plasma simulations and wave propagations. The LIDAR Thomson-scattering arrangement was successfully operated on JET and, as well, a great deal of progress has been made with the far infrared scattering on ASDEX. The flux-surface measurements on WEGA using electron-beams with a new improved detection system achieved excellent results. The plasma-focus experiments were continued. The neutron yield could be increased by a factor of two. Plasma-technology activities have demonstrated initial success.

5658 **(IPP—III/136) ASDEX contributions to the 15th European conference on controlled fusion and plasma physics.** (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). May 1988. 125p. (CONF-880534—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW.

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

This report is a collection of 23 IPP Garching contributions concerning confinement studies, plasma heating, impurity studies, plasma stability, and plasma diagnostics. 5 of these contributions have been separately indexed into the data base.

5659 (IPP—III/136, pp 69-72) **Transport analysis of the L-to-H transition in ASDEX by computer simulation.** Becker, G. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). May 1988. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW. (CONF-880534—).

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

The transport properties and ideal ballooning stability during the L-phase and a burst-free period at the beginning of the H-phase are explored by computer modelling. It is found that the diffusivities X/sub e/ and D are reduced in the steep gradient zone by a typical factor of six a few ms after the H-transition. Local transport in the inner plasma improves at an early stage by a factor of about two. Prior to and after the H-transition both electrons and ions are in the banana regime. Ideal ballooning modes are shown to be stable everywhere, including the edge zone.

5660 (IPP—III/136, pp 81-84) **Parametric decay in the edge plasma of ASDEX during fast wave heating in the ion cyclotron frequency range.** Noterdaeme, J.M.; Brambilla, M.; Gernhardt, J.; Nieuwenhove, R. van; Oost, G. van; Porkolab, M. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.); Ecole Royale Militaire, Brussels (Belgium); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics; Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). May 1988. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW. (CONF-880534—).

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

For the first time, in an ICRF heated tokamak, parametric decay instabilities were observed in the plasma edge. Two types of decay processes were found. Those instabilities provide a mechanism for the direct energy deposition, seen in many tokamaks, on the ions and electrons of the scrape-off layer.

5661 (IPP—III/136, pp 93-96) **Impurity flux onto the divertor plates of ASDEX.** Martinelli, A.P.; Taglauer, E. (Association Euratom-Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). May 1988. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW. (CONF-880534—).

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

Fluxes of metallic impurities onto the divertor plates of ASDEX with different plasma parameters were collected and resolved in space and time by means of five carbon strips wound parallel on a cylindrical core rotating during the discharge. Ion beam accelerator analysis (Rutherford Backscattering Spectroscopy (RBS) , Proton Induced X-Ray Emission (PIXE)) of five carbon strips exposed to the plasma show a different distribution of the Fe and Cu atoms across the scrape-off layer (SOL). The Fe fluxes col-

lected in the centre of the SOL are related to the Fe content in the central plasma; the Cu deposition has a maximum value close to the Cu divertor plates, indicating evaporation or sputtering from the plates.

5662 (IPP—III/136, pp 1-13) **Long-pulse heating of ASDEX plasmas.** Niedermeyer, H.; Becker, G.; Bomba, B.; Bruhns, H.; Buechl, K.; Carlson, A.; Dodel, G.; Eberhagen, A.; Fahrbach, H.U.; Fussmann, G. May 1988. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW. (CONF-880534—).

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

The divertor tokamak ASDEX, its neutral injection system and its ICRH system have been modified to permit additional heating with a power of 6 MW for pulse lengths up to 10 s. The paper summarizes the arguments for long-pulse heating, describes the technicaL modifications of the divertor performed, their effect on the operational behaviour of the tokamak and presents a few typical results of recent experiments exploiting the long-pulse heating facilities.

5663 (IPP—III/136, pp 14-26) **Auxiliary heated multi-pellet-fuelled discharges in ASDEX and influence of density profile shape on confinement.** Gruber, O.; Fahrbach, H.U.; Gehre, O.; Herrmann, W.; Kaufmann, M.; Lackner, K.; Mertens, V.; Mueller, E.R.; Soeldner, F.; Wagner, F. May 1988. NTIS (US Sales Only), PC A06/MF A01. Order Number DE88755415/JAW. (CONF-880534—).

From 15. European conference on controlled fusion and plasma heating; Dubrovnik, Yugoslavia (16 May 1988).

Strongly peaked electron density profiles have been obtained in ASDEX by different refuelling methods: pellet fuelling (ohmic and co-injection heating), NBI counter-injection and recently by reduced gas puff fuelling scenarios. These discharges show in common increased density limits, a canonical electron temperature profile independent of the density profile and an improvement of the particle and energy confinement. Whereas the changes in particle transport are not fully understood, transport analyses point out that the improved energy transport can be explained by reduced ion conduction losses coming close to the neoclassical ones. The different result for the ion transport with flat and peaked density profiles is quantitatively consistent with that expected from eta/sub i/-driven modes. The analyses cannot yet explain the anomalous electron energy transport, apart from identified continuous trends such as inverse scaling with the isotope mass and enhancement with heating power.

5664 (IPPCZ—277/I) **14th Czechoslovak seminar on plasma physics and technology. Part I.** (Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu). Jul 1987. 174p. (In English, Russian). (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

Most of the 15 papers collected in the first part of the proceedings deal with various aspects of investigation and application of a low-temperature plasma, especially in plasma chemistry (5 papers) and plasma arc spraying (4 papers). Two papers refer to the optical plasma diagnostics, one reporting the spectra of nitrogen-hydrogen plasma jet, and the other the results of spectroscopic measurements of plasma temperature in various discharge plasmas. Two theoretical papers give a survey of the theory of stability of subsonic and supersonic plasma flows, and describe an extension of applicability of the collisional-radiative model for rare gas plasmas, respectively. In the remaining two papers a new low- pressure RF plasma jet is announced, and extraordinary properties of the diffuse plasma of a vacuum arc are discussed. (J.U.).

5665 (IPPCZ—277/I, pp 124-163) **Physical aspects of plasma generation in electric arcs and some plasma technologies.** Zhukov, M.F.; Lebedev, A.D. (AN SSSR, Novosibirsk. Inst. Teplofiziki). Jul 1987. (In Russian). NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

Basic physical processes governing the behaviour of plasmas in electric arcs are described. Particular attention is paid to the arcs in plasmatrons. The plasmatrons are classified into three types and similarity criteria allowing to calculate the parameters of plasmatrons of arbitrary power are found. Heat flux in the cathode spot and the dominant loss channels are discussed and ways of reducing the loss are shown. The possibility of the current channel splitting into several filaments is demonstrated experimentally. On the basis of these investigations, cathodes with much lower specific erosion can be developed. Main application fields of plasma technology are surveyed. (J.U.). 21 figs., 7 refs.

5666 (IPPCZ—277/I, pp 47-59) **On the anodic plasma expansion region of the diffuse vacuum arc.** Hantzsche, E. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Elektronenphysik). Jul 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

The experimental investigation of the vacuum arc plasma expanding from the cathode spot towards the anode and the walls reveals some surprising results incompatible with a conventional physical model. However, by applying the general energy and particle conservation laws together with the simple sheath conditions, the plasma properties in the anodic expansion region become well understandable. The results reported were achieved without resort to any specific model necessary to explain in detail the plasma expansion characteristics, the high ion energies and multiple ionization observed in vacuum arcs. Nevertheless, despite the simplifications and approximations used, they show good agreement with the measurements and illustrate well how the cathode processes influence the conditions in other discharge regions. (J.U.). 2 figs., 18 refs.

5667 (IPPCZ—277/I, pp 114-117) **New low-pressure rf plasma jet.** Bardos, L.; Dusek, V.; Lebedev, Yu.A. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav; Academy of Sciences of USSR, Moscow. Institute of Petrochemical Synthesis). Jul 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

In a plasma jet flowing through an RF electrode into a RF-created plasma the formation of a remarkably narrow plasma channel was observed. The plasma channel exhibited and extremely high degree of chemical activity. Thus, the system reported can be used in a number of practical applications. The conditions for the jet discharge generation and the discharge phenomenology were studied. A descriptive model of the plasma channel creation was proposed. (J.U.). 2 figs., 3 refs.

5668 (IPPCZ—277/I, pp 34-46) **Spectroscopic measurements of temperatures for chosen plasmas.** Zyrnicki, W.; Tomasik, Z.; Borkowska-Burnecka, J. (Politechnika Wroclawska (Poland). Inst. Chemii Nieorganicznej i Metalurgii Pierwiastkow Rzadkich). Jul 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

Rotational, vibrational and excitation temperatures in a low pressure glow discharge in a nitrogen-methane mixture and in a hollow cathode argon discharge were measured spectroscopically. The plasma spectrum was recorded in the range 220 to 500 nm by means of the plane grating spectrograph PGS-2. Both atomic and molecular spectra were employed for determining the temperatures. In both discharge types, ion excitation temperatures were found to be significantly higher than atom temperatures. On the other hand, the rotational temperature of the nitrogen molecular ion was always close to transitional temperature. Thus, this molecule can be used for temperature measurements in various discharge plasmas. The opposite applies to the OH molecule. The possibilities of spectroscopic plasma diagnostics are discussed in general. (J.U.). 5 figs. 3 tabs., 14 refs.

5669 **(JET-R—88-04) Technique for improving the relative accuracy of JET ECE temperature profiles.** Bindslev, H.; Bartlett, D.V. (Risoe National Lab., Roskilde (Denmark)). (Commission of the European Communities, Abingdon (UK). JET Joint Undertaking). 1988. 78p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755482/JAW.

A method for substantially improving the relative accuracy of the electron temperature profiles measured on JET using ECE [electron cyclotron emission] is presented. The improvement is obtained by reducing the relative systematic error in the spectral calibration of the Michelson interferometer which is used to measure the ECE spectrum. The errors in the calibration are evaluated by analysing the development of the measured emission spectrum from a plasma with a fixed-shape temperature profile as the toroidal field is varied. The effectiveness of the technique is investigated both theoretically and by analysis of real data. Examples are presented which illustrate the substantial improvements which can be obtained.

5670 **(LA-UR—88-3737) Formation and confinement of FRCs in FRX-C/LSM.** Chrien, R.E.; Crawford, E.A.; Hugrass, W.N.; Okada, S.; Rej, D.J.; Siemon, R.E.; Taggart, D.P.; Tuszewski, M.; Webster, R.B.; Wright, B.L. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 5p. (CONF-8811106—1). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003479/JAW.

From 10. US/Japan CT workshop; Hakone, Japan (14 Nov 1988).

The Large Source Modification of FRX-C (FRX-C/LSM) consists of a 50% increase in radius without a commensurate increase in either the coil length or capacitor bank energy. Previous studies in FRX-C/LSM compared tearing and nontearing formation in a coil arrangement which included passive mirrors and auxiliary cusp coils. The present studies use a straight coil (0.35 m radius, 2.0 m length) without passive mirrors; in this case, the cusp coils promote nontearing formation and provide mirror fields to inhibit axial drifting. This arrangement increases the length (from 1.3--2.0 m) and the length-to-diameter ratio (from 1.7--2.9) of the uniform field region. It also increases the implosion electric field from 28 to 32 kV/m. These changes tend to produce more elongated FRCs, but in all cases the axial equilibrium appears not to be influenced by the mirror fields. The FRCs are formed using a deuterium static fill varying from 2--10 mtorr, a bias field varying from 0.05--0.10 T, and preionization consisting of a zero-crossing ringing θ-pinch discharge aided by a 10 MHz RF generator. 10 refs., 2 figs.

5671 **Dissipative mode coupling in ion-cyclotron resonance minority heating.** Fuchs, V.; Bers, A. (Centre Canadien de Fusion Magnetique, Varennes, Quebec J0L 2P0, Canada). *Physics of Fluids;* **31**: No. 12, 3702-3708(Dec 1988).

Coupled wave equations and the corresponding wave-energy-flow conservation law describing the fast magnetosonic and ion-Bernstein waves are derived for minority heating in the ion-cyclotron range of frequencies. This fourth-order full-wave system is subsequently reduced in order through representation by means of two, completely decoupled, second-order systems. One is a second-order equation for the fast wave in which the Bernstein mode is treated as a driven response. The second is coupled-mode equations for amplitudes varying slowly under the influence of coupling, inhomogeneity, and dissipation. The coupled-mode equations are approximately solved for both high-field and low-field incidence to give the transmission and mode-conversion coefficients in closed form for arbitrary wavenumbers parallel to the magnetic field. Good agreement with fourth-order calculations is obtained.

5672 **Plasma production and heating in a tandem mirror central cell by radio-frequency waves in the ion cyclotron frequency range.** Golovato, S.N.; Brau, K.; Casey, J.; Coleman, J.; Gerver, M.J.; Guss, W.; Hallock, G.; Horne, S.; Irby, J.; Kumazawa, R.; and others. (Plasma Fusion Center, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **31**: No. 12, 3744-3753(Dec 1988).

Plasma production and heating in the central cell of the Tara tandem mirror [Nucl. Fusion 22, 549 (1982); Plasma Physics and Controlled Nuclear Fusion Research, 1986, Proceedings of the 11th International Conference, Kyoto, Japan (IAEA, Vienna, 1987), Vol. 2, p. 251] have been studied. Using radio-frequency excitation by a slot antenna in the ion cyclotron frequency range (ICRF), plasmas with a peak β/sub perpendicular/ of 3%, density of 4 x 10^{12} cm^{-3}, ion temperature of 800 eV, and electron temperature of 75—100 eV were routinely produced. The plasma radius decreased with increasing ICRF power, causing reduced ICRF coupling and saturation of the plasma beta. About 70% of the applied ICRF power can be accounted for in direct heating of both ions and electrons. Wave field measurements have identified the applied ICRF to be the slow, ion cyclotron wave. In operation without end plugging, the plasma parameters were limited by poor axial confinement and the requirements for maintenance of magnetohydrodynamic stability and microstability.

5673 **Semiempirical formation model for field-reversed configurations.** Tuszewski, M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **31**: No. 12, 3754-3759(Dec 1988).

Recent data from the FRX-C [Proceedings of the 7th Symposium on the Physics and Technology of Compact Toroids (Los Alamos National Laboratory, Los Alamos, NM, 1986), p.142] and FRX-C/LSM [Proceedings of the 14th European Conference on Controlled Fusion and Plasma Physics (European Physical Society, Madrid, 1987), p.

5674 **Particle simulations of merging ion rings in resistive plasmas.** Lyster, P.M.; Sudan, R.N. (Laboratory of Plasma Studies, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **31**: No. 12, 3760-3767(Dec 1988).

A numerical study, employing the particle code r-smcaps-INg-smcapsA [Plasma Phys. 23, 521 (1981)], of two ion rings that merge with each other due to their mutual magnetic attraction is presented. It is shown that an ion ring with closed magnetic field lines (field reversed) can be formed by merging two weaker non-field-reversed rings. A rough calculation shows that there is an optimal plasma conductivity $\sigma \cong c^2/4\pi aR\Omega zeta^1/sup\ //^2$ (a and R are the respective axial width and major radius of the ring, Ω is the ion cyclotron frequency in the external magnetic field, and zeta is the field reversal factor of the weaker ring) for which most of the energy of mutual magnetic attraction between the rings is dissipated during the process of merging.

5675 **Measurements and implications of Z/sub eff/ profiles on the DIII-D tokamak.** Schissel, D.P.; Stockdale, R.E.; St. John, H.; Tang, W.M. (General Atomics, San Diego, California 92138-5608). *Physics of Fluids;* **31**: No. 12, 3738-3743(Dec 1988).

Here Z/sub eff/ profiles have been obtained across the entire minor radius of the DIII-D [Fusion Technol. 8, 441 (1985); Plasma Physics and Controlled Nuclear Fusion Research, 1986 (IAEA, Vienna, 1987), Vol. 1, p. 159] tokamak from measurements of visible bremsstrahlung continuum radiation. The Z/sub eff/ profiles are presented for Ohmic divertor and limiter plasmas as well as for neutral beam heated H-mode and L-mode plasmas. The measured Z/sub eff/ profiles are found to have small gradients over the entire plasma cross section. This implies that resistivity gradient driven electrostatic modes are unlikely to influence the confinement properties in the edge region of these discharges. The H-mode plasma has a centrally peaked Z/sub eff/ profile and a relatively flat electron density profile that suggests the existence of a negative value for the parameter eta/sub i/.

5676 **Transport simulations of a density limit in radiation-dominated tokamak discharges: profile effects.** Stotler, D.P. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Physics of Fluids;* **31**: No. 12, 3713-3726(Dec 1988).

The density limit observed in tokamak experiments is thought to be due to a radiative collapse of the current channel. A transport code coupled with a magnetohydrodynamic (MHD) equilibrium routine is used to determine the detailed, self-consistent evolution of the plasma profiles in tokamak discharges with radiated power close to or equaling the input power. The present work is confined to Ohmic discharges in steady state. It is found that the

shape of the density profile can have a significant impact on the variation of the maximum electron density with plasma current. Analytic calculations confirm this result.

5677 **Neoclassical tearing modes in a tokamak.** Hahm, T.S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Physics of Fluids;* **31**: No. 12, 3709-3712(Dec 1988).

Linear tearing instability is studied in the banana collisionality regime in tokamak geometry. Neoclassical effects produce significant modifications of Ohm's law and the vorticity equation, so that the growth rate of tearing modes driven by Δ' is dramatically reduced compared to the usual resistive magnetohydrodynamic values. Consequences of this result, regarding the presence of pressure-gradient-driven neoclassical resistive interchange instabilities and the evolution of magnetic islands in the Rutherford regime, are discussed.

5678 **Alpha-particle effects on high-n instabilities in tokamaks.** Rewoldt, G. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08543). *Physics of Fluids;* **31**: No. 12, 3727-3737(Dec 1988).

Hot alpha particles and thermalized helium ash particles in tokamaks can have significant effects on high toroidal mode number instabilities such as the trapped-electron drift mode and the kinetically calculated magnetohydrodynamic ballooning mode. In particular, the effects can be stabilizing, destabilizing, or negligible, depending on the parameters involved. In high-temperature tokamaks capable of producing significant numbers of hot alpha particles, the predominant interaction of the mode with the alpha particles is through resonances of various sorts. In turn, the modes can cause significant anomalous transport of the alpha particles and the helium ash. Here, results of comprehensive linear eigenfrequency—eigenfunction calculations are presented for relevant realistic cases to show these effects.

5679 **Evidence for a pressure-driven instability in the CTX spheromak.** Wysocki, F.J.; Fernandez, J.C.; Henins, I.; Jarboe, T.R.; Marklin, G.J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **61**: No. 21, 2457-2460(21 Nov 1988).

Recent improvements in the operation of the CTX spheromak device have produced discharges containing evidence for a pressure-driven instability. The instability leads to a distinct event in the discharge, which can be studied in detail. Data are presented which reasonably discount Taylor relaxation of the current profile as the cause of the event. The critical value of the normalized pressure gradient has been measured and is compared to the Mercier limit.

5680 **Direct evidence of ponderomotive filamentation in a laser-produced plasma.** Young, P.E.; Baldis, H.A.; Drake, R.P.; Campbell, E.M.; Estabrook, K.G. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **61**: No. 20, 2336-2339(14 Nov 1988).

We present an experiment in which the ponderomotive filamentation instability is driven in a preformed, underdense plasma. The spatial profile of the driving beam is intentionally modulated to produce a striated intentisy distribution of known periodicity. Darkfield imaging is used to observe the density perturbations produced by the instability. The observed threshold intensity for perturbation wavelengths of 42 μm is approximately 3 x 10/sup 13/ W/cm^2 which compares favorably with homogeneous instability theory.

5681 **Resistance probe for energetic particle dosimetry.** Wampler, W.R. (to Dept. of Energy, Washington, DC). US Patent 4,767,591. 30 Aug 1988. Filed date 23 Feb 1983. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A probe is described for determining the energy and flux of particles in a plasma, comprising: a thin annealed carbon film adapted to be brought into contact with a plasma, the film having an electrical resistance which is related to the number of plasma particles impacting the film; means for passing an electrical current through the film; and means for determining the electrical resistance of the film to the current therethrough.

5682 **X rays from laser plasmas.** Richardson, M.C. Bellingham, WA; SPIE Society of Photo-Optical Instrumentation Engineers (1987). 325p. (CONF-8708233—). SPIE Society of Photo-Optical Instrumentation Engineers, 1022 19 St., P.O. Box 10, Bellingham, WA 98227.

From X-rays from laser plasmas; San Diego, CA, USA (19 Aug 1987).

This book contains over 40 selections. Some of the titles are: X-ray emission from high-Z spherical laser plasmas: Implications for plasma dynamics; High-Z interaction physics on Nova; Laser plasma image to multilayer mirrors; and Spectroscopy of neon-like and nickel-like ions in laser-produced plasmas.

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REFER ALSO TO CITATION(S) 5652, 5657, 5682, 5682

5683 **(CEA-R—5458) Post-irradiation measurements of residual tritium and helium 4 quantities in lithium aluminate (γLiAlO/sub 2/).** Bonal, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)). 1988. 242p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE88755996/JAW.

The blanket of future fusion reactors will be used to recover heat and tritium. It is therefore essential to be able to extract tritium. It is possible to extract the totality of the residual tritium and helium contained in irradiated γLiAlO/sub 2/ samples heated under vacuum or by means of a buyoant gas between 930/sup 0/C and 1000/sup 0/C. The irradiation temperature and the nature of the barrel material play a domînant part in tritium recovery. The residual tritium content decreases when the irradiation temperature increases in the range 250-520/sup 0/C. The reduction of the tritiated water released on the steel barrel minimizes the residual tritium content. This cannot be observed on a barrel made up of an Aluminium-Magnesium alloy. Beyond 500/sup 0/C, surface desorption phenomena are dominant, the increase in the residual tritium content is proportional to the specific surface area of the samples. At 300/sup 0/C, this content is higher in the coarse grained samples. The helium 4 retention is low and not so dependent on the irradiation temperature. The fraction of residual helium 4 in coarse grained samples is lower than in fine grained samples. At 975/sup 0/C, the helium 4 release is controlled by diffusion phenomena, this is not the case at 655/sup 0/C and 750/sup 0/C.

5684 **(CONF-881031—38) Mechanical performance of fusion solid breeders and multiplier materials.** Billone, M.C.; Grayhack, W.T. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003594/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The data base for thermal expansion, elastic constants, compressive and tensile failure strength, and secondary thermal creep of leading solid-breeder (Li_2O, Li_4SiO_4, and $LiAlO_2$) and multiplier (Be) materials is reviewed. Correlations for these properties are presented as a function of temperature, porosity, grain size, and stress (for thermal creep). Several stress analysis problems are then solved to assess whether the materials are likely to crack during operation and whether the breeder/multiplier materials are "soft" relative to structural materials after contact has been achieved. The primary purpose of the data base assessment and the stress analysis is to determine which properties have a significant impact on blanket lifetime and whether or not more data are needed for these properties. 18 refs., 4 figs., 1 tab.

5685 **(CONF-881031—39) Water-cooled solid-breeder concept for ITER.** Gohar, Y.; Baker, C.C.; Attaya, H.; Billone, M.; Clemmer, R.C.; Finn, P.A.; Hassanein, A.; Johnson, C.E.; Majumdar, S.; Mattas, R.F. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 8p. NTIS, PC A02 - OSTI. Order Number DE89003593/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

A water-cooled solid-breeder blanket concept was developed for ITER. The main function of this blanket is to produce the necessary tritium for the ITER operation. Several design features are incorporated in this blanket concept to increase its attractiveness. It is assumed that the blanket operation at commercial power reactor conditions can be sacrificed to achieve a high tritium breeding ratio with minimum additional research and development, and minimal impact on reactor design and operation. Operating temperature limits are enforced for each material to insure a satisfactory blanket performance. In fact, the design was iterated to maximize the tritium breeding ratio and satisfy these temperature limits. The other design constraint is to permit a large increase in the neutron wall loading without exceeding the temperature limits for the different blanket materials. The blanket concept contains 1.8 cm of Li_2O and 22.5 cm of beryllium both with a 0.8 density factor. The water coolant is isolated from the breeder material by several zones which reduces the tritium buildup in the water by permeation, reduces the chance for water-breeder interaction, and permits the breeder to operate at high temperature with a low temperature coolant. This improves the safety and environmental aspects of the blanket and eliminates the costly process of the tritium recovery from the water. The key features and design analysis of this blanket are summarized in this paper. 11 refs., 2 figs., 3 tabs.

5686 **(CONF-881031—40) Lifetime analysis of the ITER first wall and divertor plates.** Mattas, R.F. (Argonne National Lab., IL (USA)). Aug 1988. Contract W-31109-ENG-38. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89003939/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

The performance of the ITER first wall and divertor plate is analyzed using a 1-D life-time code which includes the effects of radiation damage and surface erosion. The materials considered for the first wall are solution annealed and 20% cold-worked Type 316 stainless steel. The materials considered for the divertor plate are H-451 graphite bonded to a Cu-0.5 Be-2 Ni heat sink. The primary conclusion is that it is crucial to include radiation effects for obtaining realistic predictions of performance. 9 refs., 13 figs., 1 tab.

5687 **(CONF-8810231—1) Jet pellet ablation studies and projections for CIT and ITER.** Houlberg, W.A.; Milora, S.L.; Baylor, L.R. (Oak Ridge National Lab., TN (USA)). 1988. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - OSTI. Order Number DE89002978/JAW.

From IAEA technical committee meeting on pellet injection and toroidal confinement; Gut Ising, F.R. Germany (24 Oct 1988).

Pellet penetration in JET is analyzed and compared with predictions of the neutral gas and plasma shielding (NGPS) model for pellet ablation. The model is then used to evaluate pellet penetration in CIT and ITER. A simplified scaling law is derived for pellet penetration when the shielding is dominated by the cold ablatant plasma. Comparison with a similarly derived scaling law for the original neutral gas shielding (NGS) model shows that pellet size and plasma electron temperature dependences are similar, but velocity scaling is reduced or completely absent in the NGPS model. We show that projected penetration for higher-velocity pellets may be erroneous with the NGPS model. If the neutral gas shield dominates, as it probably does if the neutral gas shield is elongated along the magnetic field, pellet penetration in JET, CIT, and ITER can be significantly enhanced with higher pellet velocities. 13 refs., 2 figs., 2 tabs.

5688 **(DOE/ER/52140—2) Nuclear design and analysis of ITER: Progress report, November 15, 1987--November 14, 1988.** Kulcinski, G.L.; Sawan, M.E.; Sviatoslavsky, I.N. (Wisconsin Univ., Madison (USA)). Aug 1988. Contract FG02-87ER52140. 39p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003816/JAW.

Over the past year we participated in the ITER design effort. The contribution of the Fusion Technology Institute at the University of Wisconsin was mainly in the Nuclear Design and Analysis area. The activities included the inboard shield design, the aqueous Li salt blanket design, and the development of blanket evaluation criteria to be used for blanket selection. This paper describes the analysis performed in each of these areas and discusses the major finds. 20 refs., 12 figs., 7 tabs.

5689 **(GA-A—19369) Review of the nuclear data status and requiements for fusion reactors.** Cheng, E.T. (General Atomics Co., San Diego, CA (USA)). Aug 1988. Contract AC03-84ER53158. 7p. (CONF-880546—38). NTIS, PC A02/MF A01. Order Number DE89003612/JAW.

From International conference on nuclear data for science and technology; Mito, Japan (30 May 1988).

Requirements and status of nuclear data for fusion reactors are reviewed and discussed. Special emphasis is on the review of neutron multiplication cross-sections, tritium production in ^7Li, and activation cross-sections leading to the production of long-lived radionuclides. 32 refs., 2 figs., 7 tabs.

5690 **(GA-A—19432) A new water-cooled lead blanket concept.** Cheng, E.T.; Creedon, R.L.; Wong, C.P.C.; Sze, D.K. (General Atomics Co., San Diego, CA (USA)). Nov 1988. Contract AC03-84ER53158;W-31109-ENG-38. 9p. (CONF-881031—34). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003613/JAW.

From 8. topical meeting on technology of fusion energy; Salt Lake City, UT, USA (9 Oct 1988).

Lead has been widely investigated as a candidate blanket material in the form of lithium-lead eutectic for D-T fueled fusion reactors. A new lead blanket concept is conceived that could be cooled by pressurized water and which mitigates the potential polonium and chemical activity concerns. One of the new ideas in the new lead blanket concept is the minimization of the lithium content in the lithium-lead material in order to further reduce the chemical activity with water. The minimum lithium concentration in this new Li-Pb alloy for achieving a tritium breeding ratio of 1.2 is 5 at.%. The other new idea is to mitigate the polonium leakage concern by using sealed tubes containing the recommended Li-Pb material. The bred tritium will permeate through the tube walls into the water coolant and be extracted. The tritium inventory in the blanket will be primarily that in the water coolant, amounting to about 320 g. 14 refs., 3 figs., 4 tabs.

5691 **(GTFR—81) The INTOR [International Tokamak Reactor] Workshop: An unique international collaboration in fusion.** Stacey, W.M. (Georgia Inst. of Tech., Atlanta (USA). Fusion Research Center). [1988]. Contract AS05-78ET52025. 55p. NTIS, PC A04. Order Number DE88015576/JAW.

The history and technical accomplishments of the International Tokamak Reactor Workshop during its nine years of existence are reviewed. 7 refs.

5692 **(IAP—114/87) Stability and nonlinear dynamics of condensed matter.** Kaercher, B.; Kull, H.J.; Mulser, P.; Pfalzner, S.; Viehl, M. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Angewandte Physik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Sep 1987. 19p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE88755575/JAW.

The study investigates the problem of Rayleigh-Taylor instabilities in inhomogeneous media, including the effects of thermal conduction and convection. This problem is of significance in connection with the ablative stabilization of fusion targets.

5693 (INIS-mf—11328, pp 53) **Experimental investigations of muon-catalyzed nuclear fusion in cold hydrogen-tritium mixtures.** Ackerbauer, P.; Breunlich, W.H.; Cargnelli, M. and others. (Oesterreichische Akademie der Wissenschaften, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5694 (INIS-mf—11328, pp 76) **Muon-catalyzed nuclear fusion in solid, liquid and gaseous dt mixtures.** Ackerbauer, P.; Breunlich, W.H.; Cargnelli, M. and others. (Oesterreichische Akademie der Wissenschaften, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5695 (INIS-mf—11328, pp 78) **Muon-catalyzed dμt nuclear fusion at low tritium concentrations.** Ackerbauer, P.; Breunlich, W.H.; Cargnelli, M. and others. (Oesterreichische Akademie der Wissenschaften, Vienna). 1988. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88704803/JAW. (CONF-8809186—).

From Annual convention of the Austrian Physical Society; Vienna, Austria (26 Sep 1988).

5696 (IPPCZ—277/I, pp 83-113) **Modern theory of stability of subsonic and supersonic flows of a low-temperature plasma.** Rutkevich, I.M. (AN SSSR, Moscow. Inst. Vysokikh Temperatur). Jul 1987. NTIS (US Sales Only), PC A08/MF A01. Order Number DE88704806/JAW. (CONF-8703303—).

From 14. Czechoslovak seminar on plasma physics and technology; Liblice, Czechoslovakia (3 Mar 1987).

A review of modern analytical methods and of the results of theoretical studies of stability of low-temperature plasma flows is given. New theoretical results pertaining to the wave phenomena and instabilities in a sufficiently dense, slightly ionized equilibrium plasma are discussed. Starting from the basic equations, various types of short waves and the mechanisms of their amplification are discussed. For calculation of the travelling waves in a nonuniform plasma flow the method of geometric acoustics is used. Nonlocal effects due to instantaneous propagation of electric potential disturbances are discussed. The spectral stability of subsonic and supersonic nonuniform flows in MHD channels with respect to quasi-one-dimensional and two-dimensional perturbations is investigated. Some general properties of the spectrum and types of possible instabilities are described. (J.U.). 11 figs., 52 refs.

5697 (IPPJ—859, pp 140-159) **Efficient shell implosion and target design.** Murakami, M.; Nishihara, K.; Takabe, H. (Osaka Univ., Suita (Japan). Inst. of Laser Engineering). Feb 1988. NTIS (US Sales Only), PC A15/MF A01. Order Number DE89780016/JAW. (CONF-8709359—).

From Symposium on physics of target implosion and pulsed power techniques; Yokohama, Japan (30 Sep 1987).

The optimization of laser and thermonuclear target systems is of great interest in inertial confinement fusion (ICF). Spherical compression has the crucial problems such as the Rayleigh-Taylor (R-T) instability or fuel and pusher mixing at stagnation phase. Recently, by the careful choice of implosion modes, the neutron yield as high as 10/sup 13/ has been achieved at the Institute of Laser Engineering, Osaka University, using the twelve-beam green GEKKO-12 laser. In the experiment, the large targets of high aspect ratio were used so that the stagnation phase is less important for neutron production. Thus the optimum aspect ratio is one of the key variables in the design of ICF pellets. It was shown that the coupling efficiency is essentially a function of the aspect ratio. A simple model was developed to estimate plasma parameters at peak compression, and its validity was proved by comparing with a large number of the experimental data. It was discussed how the nonuniformity of absorption or shell thickness affects the neutron production. A scaling for an optimum initial radius versus laser energy was derived. The comparison between the theory and the experiment for CD shell targets was shown. Thus a main point of this paper is that the model analysis leads to a simple, qualitative, physical picture of ablative implosion of high aspect ratio targets. (Kako, I.).

5698 **(Juel-Spez—450) Report on an informal meeting on hydrogen transport and solubility in carbon materials, Aachen, May 5, 1988, Federal Republic of Germany.** Philipps, V.; Tanabe, Tetsuo. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 1 - Nuklearchemie; Osaka Univ. (Japan). Dept. of Nuclear Engineering). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Projekt Kernfusion; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie 1 -Nuklearchemie). Jun 1988. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE88755964/JAW.

On the occasion of the 8th international conference on plasma surface interaction in Juelich an informal meeting was held in Aachen, the 5th of May. The aim of this meeting was to discuss the present knowledge on transport and solubility of hydrogen in carbon and to recommend future work necessary in this field. This report summarises the main topics discussed in this meeting. In the saturated surface layer the hydrogen behaviour has been discussed according to the following scenario: implantation; thermalisation; trapping; ion induced and thermal detrapping; internal recombination to molecules; and subsequent migration and release of the molecules.

5699 **(KFK—4418) Nuclear fusion project. Semi-annual report of the Association KfK/EURATOM. October 1987 - March 1988.** Kast, G. (comp.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion). Jul 1988. 86p. (EUR—10541e). NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755423/JAW.

Given is a survey of 38 technology tasks, the development of ECRH power sources at 150 GHz, and 9 NET study are listed in the appendices I and II, respectively, while the KfK departments contributing to the Fusion Project and the Fusion Project Management Staff are listed in appendices III and IV, respectively.

5700 **(LA-UR—88-3831) Pellet injection in the RFP [Reversed Field Pinch].** Wurden, G.A.; Weber, P.G.; Munson, C.P.; Cayton, T.E.; Bunting, C.A.; Carolan, P.G. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 7p. (CONF-8810231—2). NTIS, PC A02/MF A01. Order Number DE89003496/JAW.

From IAEA technical committee meeting on pellet injection and toroidal confinement; Gut Ising, F.R. Germany (24 Oct 1988).

Observation of pellets injected into the ZT-40M Reversed Field Pinch has allowed a new twist on the usual tokamak ablation physics modeling. The RFP provides a strong ohmic heating regime with relatively high electron drift parameter (ξ/sub drift/ {approximately} 0.2), in the presence of a highly sheared magnetic field geometry. In situ photos of the pellet ablation cloud using a grated-intensified CCD camera, as well as two-view integrated photos of the pellet trajectory show substantial modification of the original pellet trajectory, in both direction and speed. Depending on the launch geometry, increases in the initial 500 m/s pellet speed by 50% have been observed, and a ski jump deflector plate in the launch port has been used to counteract strong poloidal curvature. In contrast to the tokamak, the D/sub α/ light signature is strongest near the edge, and weaker in the plasma center. Additional information on ion temperature response to pellet injection with 20 μsec time resolution has been obtained using a 5-channel neutral particle analyzer (NPA). The energy confinement is transiently degraded while the beta is largely unchanged. This may be indicative of pellet injection into a high-beta plasma operating at fixed beta. 10 refs., 6 figs.

5701 **(RISO-M—2707) Development of H2 pellet injectors for industrial marketing. Report from industrial research education programme of the Academy of Technical Sciences.** Visler, T. (Risoe National Lab., Roskilde (Denmark)). Sep 1988. 106p. (In Danish). NTIS (US Sales Only), PC A06/MF A01 - Risoe Library, DK-4000 Roskilde. Order Number DE88755676/JAW.

1. Discussion of the construction of injector installation at ETA-BETA II. 2. Production and experience with two different "pipe-guns". One for large pellets, diameter/length = 4.5-5 mm/8-

20 mm and one for small pellets, diameter/length = 2 mm/3-4 mm. (author) 27 ills., 39 refs.

5702 **(SAND—88-8212) Tritium retention in TFTR.** Wilson, K.L.; Dylla, H.F. (eds.). (Sandia National Labs., Livermore, CA (USA); Princeton Univ., NJ (USA). Plasma Physics Lab.). Oct 1988. Contract AC04-76DR00789;AC02-76CH03073. 134p. NTIS, PC A07/MF A01. Order Number DE89003044/JAW.

This report discusses the materials physics related to D-T operation in TFTR. Research activities are described pertaining to basic studies of hydrogenic retention in graphite, hydrogen recycling phenomena, first-wall and limiter conditioning, surface analysis of TFTR first-wall components, and estimates of the tritium inventory. 93 refs., 52 figs., 10 tabs.

5703 **Protective interior wall and attaching means for a fusion reactor vacuum vessel.** Phelps, R.D.; Upham, G.A.; Anderson, P.M. (to Dept. of Energy, Washington, DC). US Patent 4,767,592. 30 Aug 1988. Filed date 1 Mar 1985. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

A protective wall for the interior surface of a fusion reactor vessel wall is described comprising: an array of plates, each plate of the array including a main body section, a pair of edge sections bent at an angle with respect to the main body section, and a pair of flange-like end sections each having protruding sections with cut-aways therein, the protruding sections of the flange-like end sections extending in a direction substantially parallel to the main body section; and means operatively associated with the protruding sections of the flange-like end sections of the plates for mounting the array of plates to an associated vessel wall to be protected.

5704 **Anomalous - Viscosity current drive.** Stix, T.H.; Ono, M. (to Dept. of Energy, Washington, DC). US Patent 4,767,590. 30 Aug 1988. Filed date 25 Apr 1986. vp. Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes in a tokamak, which includes a toroidal vacuum chamber and a magnetically confined main plasma disposed therein, and a scrape-off region disposed between the main plasma and the vacuum chamber, the main plasma has an edge region and a main current, wherein the improvement comprises: means for generating and maintaining an electric current having a current density greater than the average current density of the main current, in the edge region of the main plasma, the edge current being maintained in a direction parallel to the main current for a period of the order of one edge current decay time, wherein the edge current flowing in the direction of the main current, will penetrate radially into the main plasma thereby augmenting and maintaining the main current.

99 GENERAL AND MISCELLANEOUS

9901 Management

REFER ALSO TO CITATION(S) 5699, 5729

5705 (ACIESP—60-Vol.4, pp 318-324) **Department of nuclear installation and materials-DIN- Activities.** Rozental, J. de J. 1988. NTIS (US Sales Only), PC A20/MF A01. Order Number DE88704677/JAW. (CONF-8808156—).

From 6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil (10 Aug 1988).

The activities developed by the Department of Nuclear Installations and Materials of Brazilian Nuclear Energy Commission are described. (E.G.).

5706 **(PNL-SA—16144) Establishment of minimum requirements and management of QA [quality assurance] in an R & D organization.** Hughey, C.E. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1988. Contract AC06-76RL01830. 10p. (CONF-881077—9). NTIS, PC A03/MF A01. Order Number DE89002884/JAW.

From 15. annual national Energy Division conference; San Antonio, TX, USA (23 Oct 1988).

Many factors are producing an increasing demand for formal quality assurance programs in R&D organizations. However, successful application of QA to the scientific disciplines and R&D staff is uniquely challenging. This is especially true in the DOE multiprogram laboratories where DOE has mandated formal QA systems based on the ANSI/ASME NQA-1 Standard and where the past culture has tended to be academic and collegiate. This paper describes how a formal QA program, based on NQA-1, has been evolved and effectively implemented in a multiprogram national laboratory. The description covers the obstacles that have to be addressed and discusses the establishment of minimum and baseline standards which marry the basic requirements of NQA-1 with the basic principles of scientific discipline and good management practices. 8 refs., 3 figs.

5707 **(UCRL—97342) Does system response time disrupt working memory?.** Schultz, E.E. Jr.; Uejio, J.Y.; De Alvare, A.M. (Lawrence Livermore National Lab., CA (USA)). 1988. Contract W-7405-ENG-48. 12p. (CONF-881058—4). NTIS, PC A03/MF A01. Order Number DE89002930/JAW.

From Human Factors Society annual meeting; Anaheim, CA, USA (24 Oct 1988).

An experiment tested whether: (1) user performance decrements due to system response time (SRT) result from working memory disruption, and (2) SRT effects vary with task complexity. Subjects performed one- and three-step tasks resembling use of a screen editor while attempting to remember zero, three, or six digits. After each task step, SRT's of either zero, two, or six seconds were imposed. SRT increased task completion time, although more for the complex than for the simple task. There was neither a significant interaction between SRT and memory load, nor a main effect of memory load, showing that SRT does not disrupt working memory. 15 refs., 3 figs.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 4443, 4445, 4511, 4693, 4962, 4984, 5034, 5035, 5344

5708 **(CISE—3144) Expert systems for industrial diagnosis: a state-of-the-art assessment.** Guida, G.; Stefanini, A. (Politecnico di Milano (Italy). Dipt. di Elettronica; Centro Informazioni Studi Esperienze, Milan (Italy)). May 1986. 17p. (CONF-8605355—3). NTIS (US Sales Only), PC A03/MF A01. Order Number DE89770053/JAW.

From 2. international conference on on-line surveillance and monitoring; Venice, Italy (1 May 1986).

The paper analyzes the features that make expert systems suitable to many indutrial diagnosis applications, and presents a synthesis of the state-of-the-art of expert system technology in this application domain. After having characterized the application scenarios, in which industrial diagnosis plays a major role, we discuss the tasks for which are suitable and their most usual architectures. A brief survey on the major projects in the field allows a state-of-the-art assessment. Finally, we consider the most significant researches which are expected to substantially contribute, in the next years, to the development of expert systems for industrial diagnosis applications.

5709 **(DOE/ER/25009—521) A string theory for time dependent complex systems and its application to automatic decomposition.** Fox, G.C.; Furmanski, W. (California Inst. of Tech., Pasadena (USA)). Mar 1988. Contract FG03-85ER25009. 21p. (CONF-880117—8). NTIS, PC A03/MF A01 - OSTI. Order Number DE89003412/JAW.

From 3. conference on hypercube concurrent computers and applications; Pasadena, CA, USA (19 Jan 1988).

We introduce a string or world line formalism that provides a general description of time dependent complex systems. We show that it can be applied to mapping general problems onto both sequential and parallel computers. In principle it unifies the concepts of an optimizing compiler with that of parallel decomposition. We show that it reproduces and smoothly interpolates both our original load balancing methods for loosely synchronous problems and opti-

mal communication and combining algorithms such as index and fold. We evaluate two explicit implementations, the neural←router and neural←accumulator, which use an optimizing neural network. 15 refs., 11 figs.

5710 **(EUR—11300) Numerical methods in dynamic fracture mechanics.** Beskos, D.E. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). (Commission of the European Communities, Luxembourg). 1987. 94p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88756006/JAW.

A review of numerical methods for the solution of dynamic problems of fracture mechanics is presented. Finite difference, finite element and boundary element methods as applied to linear elastic or viscoelastic and non-linear elastoplastic or elastoviscoplastic dynamic fracture mechanics problems are described and critically evaluated. Both cases of stationary cracks and rapidly propagating cracks of simple I, II, III or mixed modes are considered. Harmonically varying with time or general transient dynamic disturbances in the form of external loading or incident waves are taken into account. Determination of the dynamic stress intensity factor for stationary cracks or moving cracks with known velocity history as well as determination of the crack-tip propagation history for given dynamic fracture toughness versus crack velocity relation are described and illustrated by means of certain representative examples. Finally, a brief assessment of the present state of knowledge is made and research needs are identified.

5711 **(KFK—4184) Computer code FIT.** Rohmann, D.; Koehler, T. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Feb 1987. 91p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE88755586/JAW.

This is a description of the computer code FIT, written in FORTRAN-77 for a PDP 11/34. FIT is an interactive program to decude position, width and intensity of lines of X-ray spectra (max. length of 4K channels). The lines (max. 30 lines per fit) may have Gauss- or Voigt-profile, as well as exponential tails. Spectrum and fit can be displayed on a Tektronix terminal.

5712 **(LA-UR—88-3917) The graphics advisor: A prototypical advisory expert system.** Berkbigler, K.P.; Max, P.A. (Los Alamos National Lab., NM (USA)). 1988. Contract W-7405-ENG-36. 8p. (CONF-881243—2). NTIS, PC A02/MF A01 - OSTI. Order Number DE89003587/JAW.

From Conference on expert systems for numerical computing; Lafayette, IN, USA (4 Dec 1988).

The Graphics Advisor is an expert system that helps users of the Los Alamos Integrated Computing Network select the graphics library that is best suited to the characteristics of a specific graphics application. The implementation of the system, using a commercial expert system development tool, is described. Delivery options are discussed. Although the domain knowledge of the Graphics Advisor is oriented toward libraries that are supported by the Computing and Communications Division at Los Alamos, it exemplifies a class of knowledge-based systems that are potentially useful in a variety of advisory situations. 11 refs., 4 figs.

5713 **(N—88-28676) Partitioning of regular computation on multiprocessor systems.** Lee, F.F. (Stanford Univ., CA (USA)). Feb 1988. 16p. (NASA-CR—183176; NAS—1.26:183176; CSL-TR—88-352). NTIS, PC A03/MF A01.

Problem partitioning of regular computation over two dimensional meshes on multiprocessor systems is examined. The regular computation model considered involves repetitive evaluation of values at each mesh point with local communication. The computational workload and the communication pattern are the same at each mesh point. The regular computation model arises in numerical solutions of partial differential equations and simulations of cellular automata. Given a communication pattern, a systematic way to generate a family of partitions is presented. The influence of various partitioning schemes on performance is compared on the basis of computation to communication ratio.

5714 **(N—88-28677) Queueing network models for parallel processing of task systems: an operational approach.** Mak, V.W.K. (Stanford Univ., CA (USA)). Sep 1986. 28p. (NASA-CR—183174; NAS—1.26:183174; CSL-TR—86-306). NTIS, PC A03/MF A01.

Computer performance modeling of possibly complex computations running on highly concurrent systems is considered. Earlier works in this area either dealt with a very simple program structure or resulted in methods with exponential complexity. An efficient procedure is developed to compute the performance measures for series-parallel-reducible task systems using queueing network models. The procedure is based on the concept of hierarchical decomposition and a new operational approach. Numerical results for three test cases are presented and compared to those of simulations.

5715 **(ORNL/TM—10978) Security implications of personal computer connectivity.** Andrews, W.H. Jr. (Oak Ridge National Lab., TN (USA)). Nov 1988. Contract AC05-84OR21400. 23p. NTIS, PC A03/MF A01. Order Number DE89003423/JAW.

To prepare for future investigations into the security implications of interconnecting personal computers (PCs) and specific sensitive and classified Department of State computer systems and networks, the Joint Center for Information Security Technology has performed a study of the effect that linking PCs to typical host computers or networks can have on the security of both the PCs and host systems. This report summarizes the findings of the study, which consisted of an extensive literature survey and a thorough examination of several capabilities present in a PC that do not exist in a typical computer video display terminal (VDT). Significant host vulnerabilities result from the PC's intelligence and programmability, its local storage capability, its hardware and software configurability, and its ability to accommodate a wide variety of peripheral devices. The most significant requirement for a safe connection identified by this report is a carefully designed, implemented, and maintained PC hardware and software configuration control program. Critical consequences of this connection will be to increase the scope of responsibility and the background preparation required of the PC and host Information System Security Officers. This phase of the study was not intended to produce specific recommendations for correcting identified vulnerabilities, but it is clear that allowing connection of PCs to any given host without implementing a set of security controls carefully matched to the particular systems being interconnected is dangerous. Each of the issues raised in this report should be examined for applicability to the specific connection being considered.

5716 **(SAND—88-1873C) Assisting experts in their data analysis tasks: An AI approach.** Hiebert-Dodd, K.L. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 17p. (CONF-881243—1). NTIS, PC A03/MF A01. Order Number DE89003273/JAW.

From Conference on expert systems for numerical computing; Lafayette, IN, USA (4 Dec 1988).

There are many reasons why experts examine data. This report describes an expert system that was designed as an assistant to an expert, to help with the problem of too much data and too little time, by automating many of the processing procedures and managing all the information and data that is involved in the analysis tasks. 7 refs., 5 figs.

5717 **(SAND—88-2817) A preliminary analysis of VAX gateway performance data.** Benson, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1988. Contract AC04-76DP00789. 8p. NTIS, PC A02/MF A01. Order Number DE89002993/JAW.

A preliminary analysis was performed on data collected from the system monitor file of the VAX Gateway System. The intent of the study was to determine whether simple statistical techniques might be useful in tracking performance of this critical node in the Central Computing Network. Initial results indicate that further research will be necessary to characterize the underlying process with sufficient accuracy to accomplish the objective providing simple real time performance monitoring tools. 2 refs., 4 figs.

5718 **(SLAC—234-Rev.2) HANDYPAK: A histogram and display package.** Boyarski, A. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Sep 1988. Contract AC03-76SF00515. 136p. NTIS, PC A07/MF A01 - OSTI. Order Number DE89002742/JAW.

HANDYPAK is a set of Fortran subroutines which a user may call for defining, accumulating, and outputting histograms or scatter plots. Sliced projections and statistical means and variances can be generated. Smooth curves and user specified functions or contours may also be drawn. User blocks may also be defined and manipulated. Histograms and user blocks can be saved on disk, and can be retrieved from disk at a later time. Output can be directed to a line printer, or to a variety of graphic devices. Plotting formats may be changed by the user. Windowing features allow multiple plots per page on graphic devices. Handypak also runs interactively with a conversational command language which allows histograms to be manipulated or displayed at a terminal. This code works on IBM VM/CMS and VAX/VMS operating systems.

5719 **(SLAC-PUB—4766) PASHA: An approach to computer-aided hardward debugging.** Agostini, R.C.; Walz, H.V.; Gustavson, D.B.; Barker, L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 4p. (CONF-881103—7). NTIS, PC A02/MF A01. Order Number DE89002836/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

An interactive computer-aided diagnostic tool for the SLAC FASTBUS SNOOP has been developed. The distributed software package, written in FORTH and executing concurrently on an IBM PC and on the SNOOP, automatically tests the board and allows pinpointing faults by running a set of specific tests. Special attention has been given to the menu-driven man-machine interface which guides the user through the debugging session. Details of the design and results of field trials are reported. 5 refs., 6 figs.

5720 **(SLAC-PUB—4781) IEEE P1596, a scalable coherent interface for GigaByte/sec multiprocessor applications.** Gustavson, D.B. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Nov 1988. Contract AC03-76SF00515. 4p. (CONF-881103—9). NTIS, PC A02/MF A01. Order Number DE89002813/JAW.

From IEEE nuclear science symposium; Orlando, FL, USA (9 Nov 1988).

IEEE P1596, the Scalable Coherent Interface (formerly known as SuperBus) is based on experience gained during the development of Fastbus (IEEE 960), Futurebus (IEEE 896.1) and other modern 32-bit buses. SCI goals include a minimum bandwidth of 1 GByte/sec per processor; efficient support of a coherent distributed-cache image of shared memory; and support for segmentation, bus repeaters and general switched interconnections like Banyan, Omega, or full crossbar networks. To achieve these ambitious goals, SCI must sacrifice the immediate handshake characteristic of the present generation of buses in favor of a packet-like split-cycle protocol. Wire-ORs, broadcasts, and even ordinary passive bus structures are to be avoided. However, a lower performance (1 GByte/sec per backplane instead of per processor) implementation using a register insertion ring architecture on a passive "backplane" appears to be possible using the same interface as for the more costly switch networks. This paper presents a summary of current directions, and reports the status of the work in progress.

5721 **(UCID—21564) XREF: An approach to understanding large software systems.** Rhoades, C.E. Jr. (Lawrence Livermore National Lab., CA (USA)). 10 Nov 1988. Contract W-7405-ENG-48. 22p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003710/JAW.

When a software system whether programmed in Fortran, C or some other language such as ADA reaches a certain size, arteriosclerosis sets in. That is, the system becomes harder and harder to add new features and even more difficult to understand. Worse, the insertion of new features often introduces new programming errors as well as revealing ones already present but previously unmanifested. For Fortran programs, the 100,000 line size is critical. XREF fights hardening of the arteries by providing the user information on the organization, variable usage, and common block use within the software system. XREF is language independent. That is, it works, for example, with CAL, C, CIVIC, and CFT compiled subprograms. XREF performs its global analysis from either the BUILD library file or the binary (object) file. Naturally more useful information is obtained when a symbol table is generated by the compiler. Specifically, eight global reports are produced. The most helpful report consists of a listing of all symbols contained in the BUILD library and binary file, the subprograms that use the symbol and the relocation basis (either local or common block name) of each symbol. Five secondary reports are provided for each subprogram. 3 refs.

5722 **(UCID—30205-Rev.1) LINCS Authentication Domain Interface (ADI) Logon protocol: (Preliminary specification and implementation guide).** Nessett, D.M.; Fletcher, J.G. (Lawrence Livermore National Lab., CA (USA)). 28 Oct 1988. Contract W-7405-ENG-48. 56p. NTIS, PC A04/MF A01. Order Number DE89002820/JAW.

This paper defines the Authentication Domain Interface (ADI) Logon protocol for the LINCS distributed operating system that in conjunction with the Inter-Authentication-Domain Logon protocol gives users of LINCS terminals the ability to logon to hosts that do not support LINCS. In addition, it gives users of terminals connected to networks that do not directly support LINCS the ability to logon and use LINCS distributed resources. Hereafter, for the sake of brevity, the Inter-Authentication-Domain Logon Protocol is called the IAD Logon protocol. The IAD Logon protocol specification describes how the network-level protocols, transport-level protocols, and terminal protocols of separate authentication domains can be interfaced and defines an inter-authentication-domain logon protocol that supports user authentication and user authorization in the context of multiple authentication domains. The provision of inter-authentication-domain interactive services in LINCS requires interfacing the LINCS network-level, transport-level, virtual terminal, and logon protocols to their corresponding inter-authentication-domain standards through an interactive services gateway. In LINCS, an interactive services gateway is naturally structured as a set of (potentially) distributed modules. This paper describes how a LINCS interactive services gateway can be implemented and describes the actions each of its modules take in the suggested implementation.

5723 **(UCRL—99831) Traveltime tomography and nonlinear constrained optimization.** Berryman, J.G. (Lawrence Livermore National Lab., CA (USA)). Oct 1988. Contract W-7405-ENG-48. 11p. (CONF-8810202—4). NTIS, PC A03/MF A01. Order Number DE89003174/JAW.

From 22. Asilomar conference on signals, systems and computers; Pacific Grove, CA, USA (30 Oct 1988).

Fermat's principle of least traveltime states that the first arrivals follow ray paths with the smallest overall traveltime from the point of transmission to the point of reception. This principle determines a definite convex set of feasible slowness models - depending only on the traveltime data - for the fully nonlinear traveltime inversion problem. The existence of such a convex set allows us to transform the inversion problem into a nonlinear constrained optimization problem. Fermat's principle also shows that the standard undamped least-squares solution to the inversion problem always produces a slowness model with many ray paths having traveltime shorter than the measured traveltime (an impossibility even if the trial ray paths are not the true ray paths). In a damped least-squares inversion, the damping parameter may be varied to allow efficient location of a slowness model on the feasibility boundary. 13 refs., 1 fig., 1 tab.

5724 **Fronts propagating with curvature-dependent speed: Algorithms based on Hamilton—Jacobi formulations.** Osher, S.; Sethian, J.A. (Department of Mathematics, University of California, Los Angeles, California 90024). *Journal of Computational Physics;* **79**: No. 1, 12-49(Nov 1988).

We devise new numerical algorithms, called PSC algorithms, for following fronts propagating with curvature-dependent speed. The speed may be an arbitrary function of curvature, and the front also can be passively advected by an underlying flow. These algorithms approximate the equations of motion, which resemble Hamilton—Jacobi equations with parabolic right-hand sides, by using

techniques from hyperbolic conservation laws. Non-oscillatory schemes of various orders of accuracy are used to solve the equations, providing methods that accurately capture the formation of sharp gradients and cusps in the moving fronts. The algorithms handle topological merging and breaking naturally, work in any number of space dimensions, and do not require that the moving surface be written as a function. The methods can be also used for more general Hamilton—Jacobi-type problems. We demonstrate our algorithms by computing the solution to a variety of surface motion problems. copyright 1988 Academic Press, Inc.

5725 **Comparison of finite differences and finite elements on a parabolic problem.** Shestakov, A.I. (Computational Physics Division, Lawrence Livermore National Laboratory, P.D. Box 5508, Livermore, California 94550). *Journal of Computational Physics;* **79**: No. 1, 231-243(Nov 1988).

Numerical solutions to the diffusion equation are examined on a smooth, nearly orthogonal mesh. (AIP)

5726 **Diagonal Pade approximations for initial value problems.** Reusch, M.F.; Ratzan, L.; Pomphrey, N.; Park, W. (Plasma Physics Lab., Princeton Univ., Princeton, NJ (US)). *SIAM Journal on Scientific and Statistical Computing;* **9**: No. 5, 829-838(Sep 1988).

Diagonal Pade approximations to the time evolution operator for initial value problems are applied in a novel way to the numerical solution of these problems by explicitly factoring the polynomials of the approximation. A remarkable gain over conventional methods in efficiency and accuracy of solution is obtained.

9903 Information Handling

REFER ALSO TO CITATION(S) 4229, 4437, 4473

5727 **(SAND—88-0602C) How to (really) share a secret.** Simmons, G.J. (Sandia National Labs., Albuquerque, NM (USA)). 1988. Contract AC04-76DP00789. 28p. (CONF-8808107—1). NTIS, PC A03/MF A01. Order Number DE88015692/JAW.

From Advances in cryptology conference; Santa Barbara, CA, USA (21 Aug 1988).

In information based systems, the integrity of the information (from unauthorized scrutiny or disclosure, manipulation or alteration, forgery, false dating, etc.) is commonly provided for by requiring operation(s) on the information that one or more of the participants, who know some private piece(s) of information not known to all of the other participants, can carry out but which (probably) can't be carried out by anyone who doesn't know the private information. Encryption/decryption in a single key cryptoalgorithm is a paradigm of such an operation, with the key being the private (secret) piece of information. Although it is implicit, it almost never states explicity that in a single-key cryptographic communications link, the transmitter and the receiver must unconditionally trust each other since either one can do anything that the other can. Even if it can't be assumed that all of the elements in a system are trustworthy, so long as there exists at least one identified unconditionally trustworthy element (individual or device), it is generally possible to devise protocols to transfer trust from this element to other elements of unknown trustworthiness to make it possible for users to trust the integrity of the information in the system even though they may not trust all of the elements. 41 refs., 7 figs.

5728 **(UCID—21562) The security of terminal services in heterogeneous distributed systems: Final report.** Nessett, D.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1988. Contract W-7405-ENG-48. 277p. NTIS, PC A13/MF A01. Order Number DE89003415/JAW.

The LLNL Distributed System Security Project has concentrated its attention over the past 5 years on security issues associated with terminal services provision in heterogeneous distributed systems. In this report we summarize our research findings during this period. Solutions to problems in security must begin with an understanding of the threats to be dealt with. Since terminal services rely on underlying communications services, we began our research by studying threats against interprocess communication. This lead us to develop a methodology by which these threats can be analyzed.

9905 Civilian Defense

5729 **(ORNL/TM—10818) Opportunities for integrating deliberate and time-sensitive joint depolyment planning in US-TRANSCOM component commands.** Edwards, R. (Oak Ridge National Lab., TN (USA)). 2 May 1988. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01 - OSTI. Order Number DE89003720/JAW.

The Decision System Research Section of the Oak Ridge National Laboratory (ORNL) is assisting the Deployment Directorate (formerly the Joint Deployment Agency) of the US Transportation Command (USTRANSCOM) in identifying and evaluating opportunities for improving the automation support used in deliberate and time-critical deployment planning. USTRANSCOM, which is a unified command (i.e., personnel are drawn from all services), was created in the fall of 1987 to consolidate the functions of the former Military Transportation Operating Agencies (the Military Airlift Command, the Military Traffic Management Command, and the Military Sealift Command). An important factor justifying creation of USTRANSCOM, was the possibility of combining and improving coordination in deployment planning between the organizations responsible for strategic transportation activities during times of crisis. This report, the second in a series to be produced in the course of the ORNL study, presents three possibilities for integrating deliberate and time-sensitive planning. Two proposals recommended for use by MTMC and MSC build on cooperative planning initiatives already in progress in the two commands. A unique application of relative probabilistic measures is a key element in a proposal for improving MTMC/MAC airlift planning. 35 refs., 1 tab.

5730 **(UCID—21539) Laser interactions with aerosol aureoles.** Rosen, L.C.; Creighton, J.; Mansigh, M.A.; Ipser, J. (Lawrence Livermore National Lab., CA (USA)). Aug 1988. Contract W-7405-ENG-48. 52p. NTIS, PC A04/MF A01. Order Number DE89002824/JAW.

The interaction of laser beams with atmospheric aerosols creates non-uniformities in temperature in the medium surrounding the aerosol. These variations in temperature, and therefore in the index of refraction, termed aureoles, act as scattering centers for the propagating laser beam. The time scales for the formation of the aureoles are developed within this report. The basic equations of energy balance, mass conservation and thermodynamics are used to derive the equations representing a water-droplet aerosol heated by a pulsed laser beam. These equations are solved numerically to yield the variations in aerosol surface temperature and in the surrounding medium as a function of time. The laser beam scattering is calculated for a range of parameters through the Born approximation using the computed temperatures. The range of variables for which beam scattering by atmospheric aerosol aureoles may be important is discussed. 22 refs., 28 figs., 2 tabs.